CHEMISTRY MCQ BOOKLET

# Grade 9 · Chapter 19 · Chromatography

FBISE / National Book Foundation Model Textbook companion

by Public Library

*Independent MCQs on paper chromatography, Rf calculations, procedure, and interpretation. Not copied from the book exercise. Total: 108 questions. Each item has four options, the correct letter, and a teaching explanation.*

## A. Important / Main Topics

**1. The word part 'chroma' in chromatography means:**

(A) colour
(B) writing
(C) solvent
(D) paper

**Correct Answer: A**

*Explanation: The Greek word chroma means colour and contributes the first part of the term chromatography.*

**2. The word part 'graphein' in chromatography means:**

(A) separating
(B) writing
(C) measuring
(D) heating

**Correct Answer: B**

*Explanation: The Greek verb graphein means writing, giving chromatography the historical sense of colour writing.*

**3. Chromatography is primarily an analytical tool for:**

(A) measuring electrical current only
(B) producing nuclear energy
(C) separation and analysis of mixtures
(D) melting pure metals

**Correct Answer: C**

*Explanation: Chromatography is primarily an analytical tool for separation and analysis of mixtures.*

**4. Chromatography may be coupled with which powerful identification method?**

(A) simple filtration only
(B) flame heating only
(C) weighing by ruler
(D) mass spectrometry

**Correct Answer: D**

*Explanation: Coupling chromatography with mass spectrometry combines separation with detailed molecular identification.*

**5. The basic principle of chromatography is partitioning between:**

(A) stationary and mobile phases
(B) two stationary solids only
(C) two immobile gases
(D) a flame and a wire

**Correct Answer: A**

*Explanation: The basic principle of chromatography is partitioning between stationary and mobile phases.*

**6. Why do mixture components migrate at different rates?**

(A) They all have identical attractions
(B) They have different affinities for the two phases
(C) The baseline pushes some spots

(D) Pencil changes their masses

**Correct Answer: B**

*Explanation: They have different affinities for the two phases — this correctly answers the question.*

**7. The phase that travels through the chromatographic system is the:**

(A) stationary phase
(B) baseline
(C) mobile phase
(D) locating agent

**Correct Answer: C**

*Explanation: The mobile phase is the solvent or solvent mixture that moves and carries dissolved components.*

**8. The phase that remains in place during separation is the:**

(A) mobile phase
(B) solute front
(C) sample capillary
(D) stationary phase

**Correct Answer: D**

*Explanation: The phase that remains in place during separation is the stationary phase.*

**9. A component strongly attracted to the mobile phase generally:**

(A) moves farther and faster
(B) remains at the baseline
(C) turns into cellulose
(D) makes the solvent stationary

**Correct Answer: A**

*Explanation: Greater mobile-phase affinity keeps a component travelling with the solvent for more of the run.*

**10. A component strongly attracted to the stationary phase generally:**

(A) passes beyond the solvent front
(B) moves a shorter distance
(C) has an Rf above one
(D) becomes the mobile solvent

**Correct Answer: B**

*Explanation: A component strongly attracted to the stationary phase generally moves a shorter distance.*

**11. In paper chromatography, the stationary phase is best described as:**

(A) the solvent rising up the strip
(B) the pencil baseline
(C) water absorbed on cellulose paper
(D) air outside the cylinder

**Correct Answer: C**

*Explanation: Water held on the cellulose fibres acts as the stationary phase in the textbook description.*

**12. In paper chromatography, the mobile phase is:**

(A) dry cellulose only
(B) the capillary tube
(C) the pencil mark
(D) the developing solvent or solvent mixture

**Correct Answer: D**

*Explanation: In paper chromatography, the mobile phase is the developing solvent or solvent mixture.*

**13. Filter paper is mainly made of:**

(A) cellulose
(B) calcium carbonate
(C) platinum

(D) sodium chloride

**Correct Answer: A**

*Explanation: Cellulose fibres form the paper support and hold water that functions as stationary phase.*

**14. A dye distributes repeatedly between water on cellulose and the moving solvent. This process is:**

(A) combustion
(B) partitioning
(C) neutralization
(D) electroplating

**Correct Answer: B**

*Explanation: A dye distributes repeatedly between water on cellulose and the moving solvent. This process is partitioning.*

**15. Which statement best describes affinity in chromatography?**

(A) exact mass of the paper strip
(B) temperature of a flame
(C) relative attraction of a component for a phase
(D) volume printed on a pencil

**Correct Answer: C**

*Explanation: Affinity describes how strongly a substance associates with one phase compared with the other.*

**16. A suitable paper chromatography chamber can be made from a measuring cylinder fitted with a:**

(A) burning splint
(B) condenser and burner
(C) balance pan
(D) bung and hook

**Correct Answer: D**

*Explanation: A bung closes the cylinder while a hook can suspend the paper strip in the chamber.*

**17. The specified developing solvent contains water and ethanol in the ratio:**

(A) 6:4
(B) 4:6
(C) 1:1 only
(D) 9:1

**Correct Answer: A**

*Explanation: The specified developing solvent contains water and ethanol in the ratio 6:4.*

**18. For a total of 25 cm³ solvent at a 6:4 water:ethanol ratio, the water volume is:**

(A) 10 cm³
(B) 15 cm³
(C) 6 cm³
(D) 4 cm³

**Correct Answer: B**

*Explanation: Water is six tenths of 25 cm³, so the required volume is 15 cm³.*

**19. For 25 cm³ of a 6:4 water:ethanol mixture, the ethanol volume is:**

(A) 15 cm³
(B) 6 cm³
(C) 10 cm³
(D) 4 cm³

**Correct Answer: C**

*Explanation: Ethanol is four tenths of 25 cm³, giving a required volume of 10 cm³.*

**20. Why is the closed chromatography chamber allowed to stand for about 15 minutes before development?**

(A) To dry all solvent completely

(B) To bleach the paper
(C) To turn pencil into ink
(D) To saturate it with solvent vapour

**Correct Answer: D**

*Explanation: Standing with the bung fitted allows solvent vapour to saturate the chamber atmosphere.*

**21. A saturated chamber atmosphere improves reproducibility by:**

(A) reducing uneven solvent evaporation from the paper
(B) stopping the mobile phase completely
(C) making every Rf equal to one
(D) dissolving the cellulose support

**Correct Answer: A**

*Explanation: Solvent-saturated air limits evaporation changes that could alter the solvent composition and migration.*

**22. The recommended paper for the described experiment is:**

(A) carbon paper
(B) Whatman No. 1
(C) waxed paper
(D) aluminium foil

**Correct Answer: B**

*Explanation: Whatman No. 1 filter paper provides a consistent cellulose support for the separation.*

**23. The specified width of the chromatography strip is approximately:**

(A) 25 cm
(B) 0.25 mm
(C) 2.5 cm
(D) 15 cm

**Correct Answer: C**

*Explanation: The procedure uses a narrow Whatman No. 1 strip about 2.5 centimetres wide.*

**24. The baseline is drawn approximately how far from one end of the strip?**

(A) 5 mm
(B) 15 cm
(C) 25 cm
(D) 5 cm

**Correct Answer: D**

*Explanation: A pencil baseline about five centimetres from the end provides room for safe solvent immersion below it.*

**25. Why must the baseline be drawn with pencil rather than ink?**

(A) Graphite does not dissolve and travel like ink dyes
(B) Pencil always increases Rf values
(C) Ink is a stationary phase
(D) Graphite evaporates immediately

**Correct Answer: A**

*Explanation: Pencil graphite normally remains fixed, whereas soluble ink could separate and interfere with sample spots.*

**26. The sample is applied to the baseline most suitably with a:**

(A) large beaker
(B) capillary tube
(C) burning splint
(D) metal ruler edge

**Correct Answer: B**

*Explanation: A capillary transfers a very small, controlled drop that can form a compact sample spot.*

**27. Why should the sample spot be tiny and concentrated?**

(A) It guarantees every component is pure
(B) It raises the solvent front
(C) It gives sharper separated spots
(D) It changes paper into glass

**Correct Answer: C**

*Explanation: It gives sharper separated spots — this correctly answers the question.*

**28. Applying a large dilute blot at the baseline is likely to cause:**

(A) perfectly sharp spots
(B) an Rf above two
(C) no solvent movement
(D) broad overlapping bands

**Correct Answer: D**

*Explanation: A wide starting zone spreads during development and can make component spots overlap.*

**29. After spotting, the strip is allowed to dry for about:**

(A) 15 minutes
(B) 15 seconds only
(C) one day exactly
(D) zero time

**Correct Answer: A**

*Explanation: Drying for about fifteen minutes fixes a compact sample deposit before the chromatogram is developed.*

**30. Why should the applied spot dry before the run?**

(A) To erase the baseline
(B) To reduce washing and spreading into the solvent reservoir
(C) To make ink suitable
(D) To saturate the chamber alone

**Correct Answer: B**

*Explanation: A dry compact spot is less likely to dissolve directly into the solvent pool and smear.*

**31. Only the bottom 5–6 mm of paper should dip into the:**

(A) pencil sharpener
(B) locating reagent bottle
(C) developing solvent
(D) mass spectrometer

**Correct Answer: C**

*Explanation: Only the bottom 5–6 mm of paper should dip into the developing solvent.*

**32. At the start of development, the solvent level must be:**

(A) above every spot
(B) at the top edge
(C) exactly on each spot
(D) below the sample spots and baseline

**Correct Answer: D**

*Explanation: Keeping solvent below the spots forces components to migrate with the rising front rather than dissolve away.*

**33. What is most likely if the sample spots are submerged in the solvent reservoir?**

(A) They may dissolve directly and wash off the paper
(B) Their Rf values become exactly zero
(C) The paper becomes platinum
(D) Pencil turns into cellulose

**Correct Answer: A**

*Explanation: Submerged samples can disperse into the reservoir instead of separating along the paper.*

**34. The strip should hang so that it:**

(A) is folded tightly against the wall
(B) does not touch the cylinder wall
(C) lies flat in the solvent pool
(D) rests on the baseline

**Correct Answer: B**

*Explanation: The strip should hang so that it does not touch the cylinder wall.*

**35. During development the cylinder should remain:**

(A) open beside a fan
(B) heated over a flame
(C) covered with the bung
(D) filled with dry sand

**Correct Answer: C**

*Explanation: During development the cylinder should remain covered with the bung.*

**36. The approximate development time given for the paper chromatogram is:**

(A) one second
(B) twelve hours exactly
(C) one week
(D) about one hour

**Correct Answer: D**

*Explanation: The described procedure allows roughly one hour for the solvent front to travel up the paper.*

**37. Instead of relying only on time, development should stop when the solvent front is:**

(A) 2–3 cm below the top
(B) still at the baseline
(C) past the paper top
(D) below the solvent pool

**Correct Answer: A**

*Explanation: Instead of relying only on time, development should stop when the solvent front is 2–3 cm below the top.*

**38. Why should the run stop before the solvent reaches the top edge?**

(A) Rf requires solute to pass the front
(B) The front must remain visible and measurable on the paper
(C) The top creates ninhydrin
(D) Cellulose melts there

**Correct Answer: B**

*Explanation: A front that runs off the paper cannot be marked accurately for travel-distance calculations.*

**39. Immediately after removing the strip, the solvent front should be:**

(A) covered with ink
(B) cut away
(C) marked with pencil
(D) heated until invisible

**Correct Answer: C**

*Explanation: The solvent evaporates quickly, so its maximum position must be marked at once.*

**40. After development, the chromatogram is normally:**

(A) submerged again
(B) burned in oxygen
(C) scrubbed with ink

(D) air-dried

**Correct Answer: D**

*Explanation: After development, the chromatogram is normally air-dried.*

**41. Distances for Rf calculation are measured from the:**

(A) baseline
(B) top of the cylinder
(C) bottom of the solvent reservoir
(D) edge of the bung

**Correct Answer: A**

*Explanation: Both solute and solvent-front distances use the original baseline as their common starting point.*

**42. For a broad spot, its travel distance is usually measured to the:**

(A) nearest paper edge
(B) centre of the spot
(C) top of the bung
(D) lowest solvent level

**Correct Answer: B**

*Explanation: Using the spot centre provides a consistent representative distance for calculating Rf.*

**43. Which two distances must be recorded for one Rf value?**

(A) paper width and cylinder height
(B) spot colour and drying time
(C) solute spot and solvent front from the baseline
(D) bung width and hook length

**Correct Answer: C**

*Explanation: Rf compares how far the solute moved with how far the solvent front moved from the same origin.*

**44. The formula for Rf is:**

(A) solvent distance ÷ solute distance
(B) solute distance + solvent distance
(C) paper width ÷ spot number
(D) distance travelled by solute ÷ distance travelled by solvent front

**Correct Answer: D**

*Explanation: The retardation factor is the solute migration distance divided by the solvent-front distance.*

**45. Rf is also called the:**

(A) retardation or retention factor
(B) reaction flame factor
(C) relative filtration force
(D) reagent formation fraction

**Correct Answer: A**

*Explanation: Retardation factor and retention factor are common names used for the Rf ratio.*

**46. An Rf value normally lies between:**

(A) 1 and 10
(B) 0 and 1
(C) -5 and 0
(D) 10 and 100

**Correct Answer: B**

*Explanation: A solute normally cannot travel farther than the solvent front, so its ratio is from zero to one.*

**47. If the solvent front travels 10 cm and a spot travels 8 cm, Rf equals:**

(A) 1.25
(B) 18
(C) 0.8

(D) 2

**Correct Answer: C**

*Explanation: If the solvent front travels 10 cm and a spot travels 8 cm, Rf equals 0.8.*

**48. With a 10 cm solvent front, a purple spot at 6 cm has Rf:**

(A) 1.67
(B) 16
(C) 0.06
(D) 0.6

**Correct Answer: D**

*Explanation: The retention factor is 6 divided by 10, which equals 0.6.*

**49. With a 10 cm solvent front, a red spot at 2 cm has Rf:**

(A) 0.2
(B) 5.0
(C) 12
(D) 0.02

**Correct Answer: A**

*Explanation: The solute-to-front distance ratio is 2 divided by 10, producing an Rf of 0.2.*

**50. For blue, purple, and red spots with Rf values 0.8, 0.6, and 0.2, which moved farthest?**

(A) purple
(B) blue
(C) red
(D) all moved equally

**Correct Answer: B**

*Explanation: The blue component has the greatest Rf and therefore travelled the greatest fraction of the solvent distance.*

**51. In that same example, which component is retained most strongly by the stationary phase?**

(A) blue
(B) purple
(C) red
(D) all equally

**Correct Answer: C**

*Explanation: Red — this correctly answers the question.*

**52. A spot travels 4.5 cm while the solvent front travels 9.0 cm. Its Rf is:**

(A) 2.00
(B) 4.50
(C) 13.50
(D) 0.50

**Correct Answer: D**

*Explanation: A spot travels 4.5 cm while the solvent front travels 9.0 cm. Its Rf is 0.50.*

**53. A solvent front is 12 cm from the baseline and a spot is 3 cm away. Calculate Rf.**

(A) 0.25
(B) 4.00
(C) 9.00
(D) 0.40

**Correct Answer: A**

*Explanation: "0.25" is correct: it matches the idea asked in the question ("A solvent front is 12 cm from the baseline and a spot is 3 cm away. Calculate Rf"), while the other choices do not.*

**54. A component has Rf 0.75 with a solvent front of 8 cm. How far did it travel?**

(A) 10.7 cm

(B) 6 cm
(C) 8.75 cm
(D) 0.094 cm

**Correct Answer: B**

*Explanation: 6 cm — this correctly answers the question.*

**55. A spot travelled 7 cm and has Rf 0.70. The solvent front travelled:**

(A) 4.9 cm
(B) 7.7 cm
(C) 10 cm
(D) 0.1 cm

**Correct Answer: C**

*Explanation: Rearranging the formula gives solvent distance as 7 divided by 0.70, which is 10 cm.*

**56. A spot at the baseline after development has an approximate Rf of:**

(A) 1
(B) 2
(C) 10
(D) 0

**Correct Answer: D**

*Explanation: A spot at the baseline after development has an approximate Rf of 0.*

**57. A spot that travels with the solvent front has an approximate Rf of:**

(A) 1
(B) 0
(C) 2
(D) -1

**Correct Answer: A**

*Explanation: A spot that travels with the solvent front has an approximate Rf of 1.*

**58. A reported Rf of 1.4 most strongly suggests:**

(A) perfect normal separation
(B) a measurement or calculation error
(C) a stationary solvent
(D) a pure sample by definition

**Correct Answer: B**

*Explanation: A normal spot cannot move beyond the solvent front, so a value above one signals an error.*

**59. Which Rf indicates greatest affinity for the mobile phase?**

(A) 0.62
(B) 0.31
(C) 0.92
(D) 0.08

**Correct Answer: C**

*Explanation: The largest Rf corresponds to the component spending most of its time moving with the mobile phase.*

**60. Which Rf indicates greatest affinity for the stationary phase?**

(A) 0.35
(B) 0.65
(C) 0.95
(D) 0.05

**Correct Answer: D**

*Explanation: A very small Rf means the component is strongly retained by the stationary phase.*

**61. Two spots travel 2 cm and 8 cm with a 10 cm front. Their Rf difference is:**

(A) 0.6

(B) 1.0
(C) 6.0
(D) 0.2

**Correct Answer: A**

*Explanation: Their Rf values are 0.2 and 0.8, so the difference between them is 0.6.*

**62. A 15 cm solvent front gives a spot Rf of 0.40. The spot distance is:**

(A) 37.5 cm
(B) 6 cm
(C) 15.4 cm
(D) 0.027 cm

**Correct Answer: B**

*Explanation: A 15 cm solvent front gives a spot Rf of 0.40. The spot distance is 6 cm.*

**63. If every measured distance is converted from centimetres to millimetres, the Rf:**

(A) becomes ten times larger
(B) becomes ten times smaller
(C) remains unchanged
(D) gains millimetre units

**Correct Answer: C**

*Explanation: Both distances scale equally, so their ratio remains unchanged and dimensionless.*

**64. Why does Rf have no unit?**

(A) It is measured only by colour
(B) The solvent has no distance
(C) Paper removes all units
(D) It is a ratio of two distances in the same unit

**Correct Answer: D**

*Explanation: It is a ratio of two distances in the same unit — this correctly answers the question.*

**65. The solvent front moves 7.5 cm and a spot moves 6.0 cm. Rf is:**

(A) 0.80
(B) 1.25
(C) 13.5
(D) 0.20

**Correct Answer: A**

*Explanation: The ratio of 6.0 to 7.5 is 0.80, indicating strong relative mobile-phase affinity.*

**66. Two components have Rf 0.30 and 0.32. Their separation is likely to be:**

(A) excellent because values are far apart
(B) poor because the spots may overlap
(C) impossible to measure in principle
(D) proof that both are pure

**Correct Answer: B**

*Explanation: Very similar migration ratios place spots close together and can lead to overlapping zones.*

**67. Two components have Rf 0.15 and 0.85. Compared with close Rf values, they should be:**

(A) at exactly the same position
(B) both above the front
(C) more widely separated
(D) unaffected by affinity

**Correct Answer: C**

*Explanation: Two components have Rf 0.15 and 0.85. Compared with close Rf values, they should be more widely separated.*

**68. Colourless separated components can be made visible by applying a:**

(A) pencil eraser
(B) mobile-phase hook
(C) measuring cylinder scale
(D) locating agent

**Correct Answer: D**

*Explanation: A locating agent reacts with otherwise invisible substances to produce detec.*

**69. The locating agent commonly used for amino acids is:**

(A) ninhydrin
(B) limewater
(C) ethanol alone
(D) graphite

**Correct Answer: A**

*Explanation: Ninhydrin reacts with amino acids to produce coloured spots that reveal their positions.*

**70. Why is a locating agent applied after development rather than mixed into every original spot?**

(A) It raises all Rf values above one
(B) It reveals separated colourless components at their final positions
(C) It becomes the cellulose paper
(D) It replaces the solvent front

**Correct Answer: B**

*Explanation: It reveals separated colourless components at their final positions — this correctly answers the question.*

**71. An unknown is best identified chromatographically by comparing its Rf with:**

(A) any value from a different solvent
(B) the width of another cylinder
(C) known standards run under the same conditions
(D) the mass of the bung

**Correct Answer: C**

*Explanation: Matching standards under identical conditions controls factors that can shift Rf values.*

**72. A pure substance should ideally produce:**

(A) two or more spots
(B) no solvent front
(C) an Rf above one
(D) one spot

**Correct Answer: D**

*Explanation: A pure substance should ideally produce one spot.*

**73. An impure sample usually produces:**

(A) more than one spot
(B) exactly one spot by definition
(C) a solvent front below zero
(D) no partitioning

**Correct Answer: A**

*Explanation: Multiple separated spots indicate that the sample contains more than one component.*

**74. An unknown and a standard have matching Rf values in the same run. The careful conclusion is:**

(A) identity is mathematically certain
(B) the match strongly supports, but does not absolutely prove, identity
(C) the samples must have equal masses
(D) both are necessarily pure

**Correct Answer: B**

*Explanation: Different substances can sometimes share an Rf, so matching values are strong evidence rather than absolute proof.*

**75. Rf comparisons from different experiments are valid only when important conditions are:**

(A) deliberately unrelated
(B) never recorded
(C) the same or clearly specified
(D) changed during the run

**Correct Answer: C**

*Explanation: Rf depends on experimental conditions, so meaningful comparison requires controlled and reported conditions.*

**76. Which set contains three factors that can change Rf?**

(A) Greek spelling, ruler colour, and hook shape
(B) question number, pencil brand, and time zone
(C) sample name, page number, and cylinder label
(D) solvent, paper, and temperature

**Correct Answer: D**

*Explanation: Solvent composition, stationary support, and temperature can each alter component partitioning and migration.*

**77. Why should the solvent system be quoted with an Rf value?**

(A) Changing the solvent can change relative affinities and Rf
(B) Rf is the solvent's chemical formula
(C) Solvent determines paper width only
(D) All solvents give identical values

**Correct Answer: A**

*Explanation: An Rf is characteristic only under stated conditions because solvent choice changes component migration.*

**78. A chromatogram showing one spot does not prove absolute purity because:**

(A) one spot always means three substances
(B) different components may overlap at the same position
(C) pure materials cannot move
(D) the solvent front is a spot

**Correct Answer: B**

*Explanation: Co-migrating substances can overlap and appear as one spot even when more than one component is present.*

**79. If two spots overlap, the most useful next step is to:**

(A) declare both substances identical
(B) submerge the baseline
(C) try a different suitable solvent system
(D) replace pencil with soluble ink

**Correct Answer: C**

*Explanation: Changing solvent composition can alter relative affinities and separate components that previously co-migrated.*

**80. Which result gives the strongest evidence that an unknown contains standard X?**

(A) matching paper width only
(B) different Rf in unrelated solvents
(C) a larger sample spot
(D) matching Rf in the same conditions and a matching locating response

**Correct Answer: D**

*Explanation: Matching Rf in the same conditions and a matching locating response — this correctly answers the question.*

## B. Less Important / Secondary Topics

**81. A 6:4 water:ethanol mixture is equivalent to what percentage by volume of ethanol?**

(A) 40%
(B) 60%
(C) 24%
(D) 4%

**Correct Answer: A**

*Explanation: Four of every ten volume parts are ethanol, so ethanol makes up forty percent of the mixture.*

**82. To prepare 50 cm³ of 6:4 water:ethanol solvent, how much ethanol is required?**

(A) 30 cm³
(B) 20 cm³
(C) 6 cm³
(D) 4 cm³

**Correct Answer: B**

*Explanation: 20 cm³ — this correctly answers the question.*

**83. To prepare 100 cm³ of 6:4 water:ethanol solvent, the water volume is:**

(A) 40 cm³
(B) 6 cm³
(C) 60 cm³
(D) 10 cm³

**Correct Answer: C**

*Explanation: Water contributes six of ten parts, which is sixty cubic centimetres in a 100 cm³ mixture.*

**84. The baseline is 5 cm from the dipped end while only 6 mm is immersed. The vertical gap is:**

(A) 5.6 cm
(B) 0.4 cm
(C) 44 cm
(D) 4.4 cm

**Correct Answer: D**

*Explanation: Six millimetres is 0.6 centimetres, so the baseline remains 4.4 centimetres above the solvent.*

**85. A chromatogram runs for one hour but the front is only halfway up. What criterion is more important than time alone?**

(A) the measurable front position below the top
(B) making every run exactly sixty minutes
(C) placing spots under the solvent
(D) using ink for visibility

**Correct Answer: A**

*Explanation: Development is judged by useful solvent-front travel while retaining room to mark the front accurately.*

**86. A sample is spotted repeatedly at one point, drying between applications. The purpose is to:**

(A) make the baseline soluble
(B) increase concentration without greatly enlarging the spot
(C) force Rf above one
(D) remove every component

**Correct Answer: B**

*Explanation: Repeated tiny applications can load more sample while preserving a compact starting zone.*

**87. If a chromatography strip touches the vessel wall, the solvent front may become:**

(A) chemically pure
(B) fixed at Rf one
(C) uneven
(D) a locating agent

**Correct Answer: C**

*Explanation: Wall contact can redirect solvent flow and produce a distorted front that weakens measurements.*

**88. Why is the chamber not placed beside a strong draught with its bung removed?**

(A) Air makes graphite dissolve completely
(B) A draught guarantees pure samples
(C) The mobile phase becomes stationary by definition
(D) Rapid evaporation can alter development conditions

**Correct Answer: D**

*Explanation: Rapid evaporation can alter development conditions — this correctly answers the question.*

**89. A spot moved 3.6 cm with a 12 cm solvent front. Its Rf is:**

(A) 0.30
(B) 3.33
(C) 8.40
(D) 0.03

**Correct Answer: A**

*Explanation: A spot moved 3.6 cm with a 12 cm solvent front. Its Rf is 0.30.*

**90. A component with Rf 0.55 moves how far when the solvent front moves 20 cm?**

(A) 36.4 cm
(B) 11 cm
(C) 19.45 cm
(D) 0.028 cm

**Correct Answer: B**

*Explanation: The component distance is 0.55 multiplied by twenty centimetres, which equals eleven centimetres.*

**91. A spot at 9 cm has Rf 0.75. Calculate the solvent-front distance.**

(A) 6.75 cm
(B) 9.75 cm
(C) 12 cm
(D) 1.2 cm

**Correct Answer: C**

*Explanation: “12 cm” is correct: it matches the idea asked in the question (“A spot at 9 cm has Rf 0.75. Calculate the solvent-front distance”), while the other choices do not.*

**92. The front is 11 cm and two spots are at 2.2 cm and 8.8 cm. Their Rf values are:**

(A) 0.8 and 0.2
(B) 2.2 and 8.8
(C) 5 and 1.25
(D) 0.2 and 0.8

**Correct Answer: D**

*Explanation: The front is 11 cm and two spots are at 2.2 cm and 8.8 cm. Their Rf values are 0.2 and 0.8.*

**93. Three spots have Rf 0.25, 0.50, and 0.75 with a 12 cm front. Their distances are:**

(A) 3, 6, and 9 cm
(B) 2, 4, and 6 cm
(C) 4, 8, and 12 cm
(D) 0.25, 0.50, and 0.75 cm

**Correct Answer: A**

*Explanation: Three spots have Rf 0.25, 0.50, and 0.75 with a 12 cm front. Their distances are 3, 6, and 9 cm.*

**94. If the solvent front doubles while conditions and Rf remain 0.4, the spot distance should:**

(A) remain fixed at zero
(B) also double
(C) become half

(D) exceed the front

**Correct Answer: B**

*Explanation: For a constant Rf, solute distance is directly proportional to the solvent-front distance.*

**95. Which spot order from bottom to top matches Rf 0.2, 0.6, and 0.8?**

(A) 0.8, then 0.6, then 0.2
(B) all at the baseline
(C) 0.2, then 0.6, then 0.8
(D) all above the front

**Correct Answer: C**

*Explanation: 0.2, then 0.6, then 0.8 — this correctly answers the question.*

**96. A colourless amino-acid mixture shows no spots before treatment. The next appropriate action is to:**

(A) conclude the sample contains nothing
(B) draw spots in ink
(C) submerge the finished paper
(D) apply ninhydrin as a locating agent

**Correct Answer: D**

*Explanation: Ninhydrin reacts with amino acids and reveals the positions of otherwise colourless components.*

**97. An unknown gives Rf 0.48 while a known gives 0.80 in the same run. The evidence suggests they are:**

(A) unlikely to be the same component
(B) certainly identical
(C) equal in concentration
(D) both stationary phases

**Correct Answer: A**

*Explanation: An unknown gives Rf 0.48 while a known gives 0.80 in the same run. The evidence suggests they are unlikely to be the same component.*

**98. Two standards both have Rf 0.50 under one set of conditions. What limitation is demonstrated?**

(A) Rf always identifies with certainty
(B) Different substances can share an Rf
(C) Every mixture is pure
(D) Paper has become mobile

**Correct Answer: B**

*Explanation: Coincident Rf values show why one chromatographic match alone is not absolute identification.*

**99. An unknown produces spots at Rf 0.25 and 0.70. This most directly suggests:**

(A) one component with two masses
(B) an Rf calculation above one
(C) at least two detectable components
(D) a missing mobile phase

**Correct Answer: C**

*Explanation: Two separated positions indicate that at least two substances partition differently in the system.*

**100. A reference sample gives one spot, but the unknown gives that spot plus another. The unknown is:**

(A) necessarily purer than the reference
(B) only stationary water
(C) identical with no qualification
(D) a mixture containing an additional detectable component

**Correct Answer: D**

*Explanation: The extra spot provides evidence that the unknown contains another component besides the matching one.*

**101. Why should known and unknown spots be placed on the same baseline in one run?**

(A) They experience the same developing conditions for direct comparison
(B) They must dissolve into the reservoir
(C) It forces all spots to overlap
(D) It makes paper unnecessary

**Correct Answer: A**

*Explanation: They experience the same developing conditions for direct comparison — this correctly answers the question.*

**102. If ink is used for the baseline, extra moving marks may appear because:**

(A) graphite turns into amino acids
(B) ink contains soluble dyes
(C) cellulose becomes ethanol
(D) the bung emits colours

**Correct Answer: B**

*Explanation: Ink dyes can dissolve in the mobile phase and create spots unrelated to the test sample.*

**103. A lower Rf after changing solvents means the component now has relatively:**

(A) greater mobile-phase affinity
(B) a distance beyond the front
(C) greater stationary-phase retention
(D) no interaction with either phase

**Correct Answer: C**

*Explanation: Reduced migration indicates that the balance of affinity has shifted toward the stationary phase.*

**104. A higher Rf after warming the chamber should be interpreted cautiously because:**

(A) Rf never depends on conditions
(B) warmth turns paper into ink
(C) all compounds become pure
(D) temperature is one condition that can alter Rf

**Correct Answer: D**

*Explanation: Temperature can affect solubility and partitioning, so values should only be compared under stated conditions.*

**105. Why is chromatography called analytical even when it physically separates spots?**

(A) The separation provides information about composition and identity
(B) It only manufactures bulk products
(C) It measures no observable property
(D) It is unrelated to mixtures

**Correct Answer: A**

*Explanation: The pattern of separated components supports conclusions about what a sample contains and whether it is pure.*

**106. In chromatography–mass spectrometry, chromatography first helps by:**

(A) turning every molecule into cellulose
(B) separating mixture components before mass analysis
(C) drawing the baseline in ink
(D) setting every Rf to zero

**Correct Answer: B**

*Explanation: In chromatography–mass spectrometry, chromatography first helps by separating mixture components before mass analysis.*

**107. A spot is elongated vertically rather than compact. The most likely effect is:**

(A) a perfectly exact Rf
(B) proof of one pure substance
(C) less precise choice of travel distance
(D) movement beyond the solvent front

**Correct Answer: C**

*Explanation: A spot is elongated vertically rather than compact. The most likely effect is less precise choice of travel distance.*

**108. Which report is most scientifically complete?**

(A) Rf 0.62 with no conditions
(B) the spot moved somewhere
(C) the paper had a colour
(D) Rf 0.62 using Whatman No. 1 and 6:4 water:ethanol at stated temperature

**Correct Answer: D**

*Explanation: Rf 0.62 using Whatman No. 1 and 6:4 water:ethanol at stated temperature — this correctly answers the question.*