

3. Substance X travels 4.8 cm. The solvent front travels 8.0 cm. Calculate the Rf value. [2 marks]

Part B — Interpreting Chromatograms

4. Two suspects wrote a ransom note. Police test the ink. Suspect A's pen produces 3 spots at $R_f = 0.2, 0.5, 0.8$. Suspect B's pen produces 2 spots at $R_f = 0.3, 0.6$. The ransom note ink shows spots at $R_f = 0.2, 0.5, 0.8$. Which suspect likely wrote the note? Explain your reasoning. [3 marks]

5. A food scientist in China tests whether a food colouring in a snack contains banned additives. The test shows spots matching two approved dyes and one unknown spot. What should the scientist recommend? [3 marks]

Part C — Experimental Design

6. Design an experiment to compare the dyes in Chinese, Korean, and German brands of the same type of candy (e.g. gummy bears). Include: hypothesis, method, how you would record results, and how you would compare them fairly. [5 marks]