GCSE Chemistry A (Gateway Science)

J248/01 Chemistry A C1-C3 and C7 (Foundation Tier)

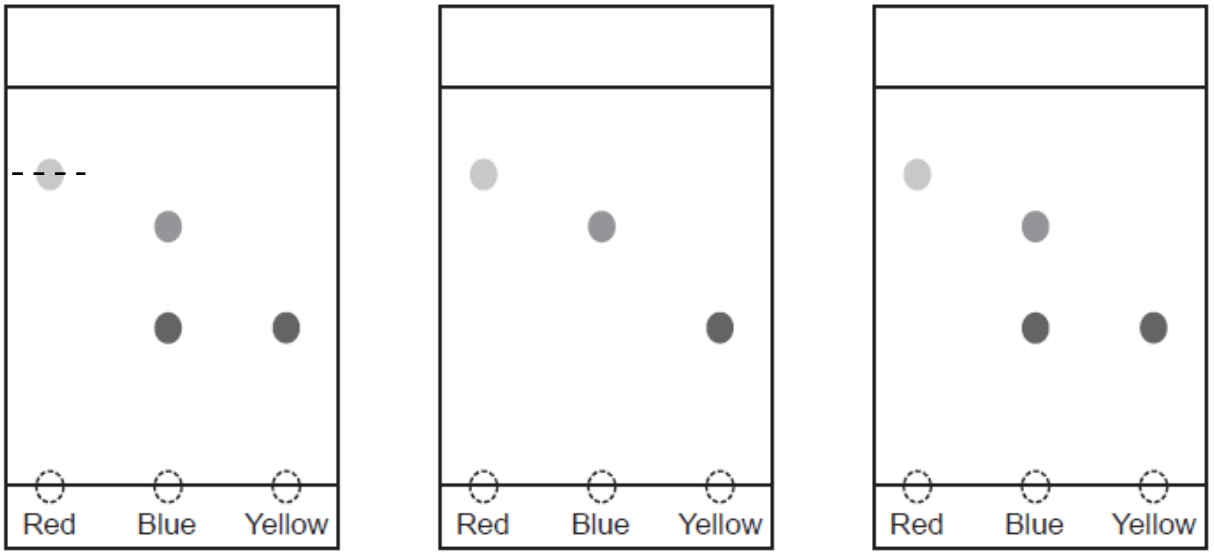
Question Set 27

1 A painting has arrived at a local museum for a new exhibit.

To make sure the painting is genuine, a sample of the paints from the painting is sent to a laboratory for analysis.

The laboratory uses thin-layer chromatography to compare the sample of the paints from the painting with some paints used in 1849 and 1973.

The chromatograms are shown below.



Sample of the paints from the painting | **Paints used in 1849** | **Paints used in 1973**

(a) (i) Look at the chromatogram for the sample of the paints from the painting.

Which paint colour(s) is/are **pure**? Red & Yellow

[1]

(ii) The red, blue and yellow paint from the painting are dissolved in different solvents, **X**, **Y** and **Z**.

The results are shown below.

		Solvent used		
		X	**Y**	**Z**
Paint colour	**Red**	Red solid left in tube	Clear red solution	Clear red solution
	Blue	Blue solid left in tube	Clear blue solution	Clear blue solution
	Yellow	Yellow solid left in tube	Clear yellow solution	Yellow solution with some yellow solid left in tube

Which solvent, **X**, **Y** or **Z**, should the laboratory use for the thin-layer chromatography? Explain why this would be better than the other solvents.

Solvent Y, because for solutes / paints to travel up the TLC, they all need to be soluble / able to dissolve in solvent not precipitate. **[2]**

(iii) Scientists use R_f values to compare the different spots on the chromatogram.

Calculate the R_f value for the **red paint** in the sample of paints from the painting.

Use the equation: $R_f = \frac{\text{distance travelled by the substance}}{\text{distance travelled by the solvent}}$

Give your answer to **2** significant figures.

$\frac{4}{5.1} = 0.7843...$

R_f = 0.78 **[3]**

(b) The laboratory think that the painting was completed in 1849.

Is the laboratory correct?

Explain your answer.

No because the position of the spots on TLC matches with paints used in 1973. 2 different compound is present in blue paint unlike the blue paint used in 1849 (which is a pure substance). **[1]**

Total Marks for Question Set 27: 7