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VCE Chemistry ½
Chromatography Qualitative & Quantitative Analysis [1.11]
Test

20 Marks. 1 Minute Reading. 16 Minutes Writing

Results:

Quiz Questions	_____ / 15
Extension	_____ / 5



Section A: Quiz Questions (15 Marks)

Question 1 (4 marks)

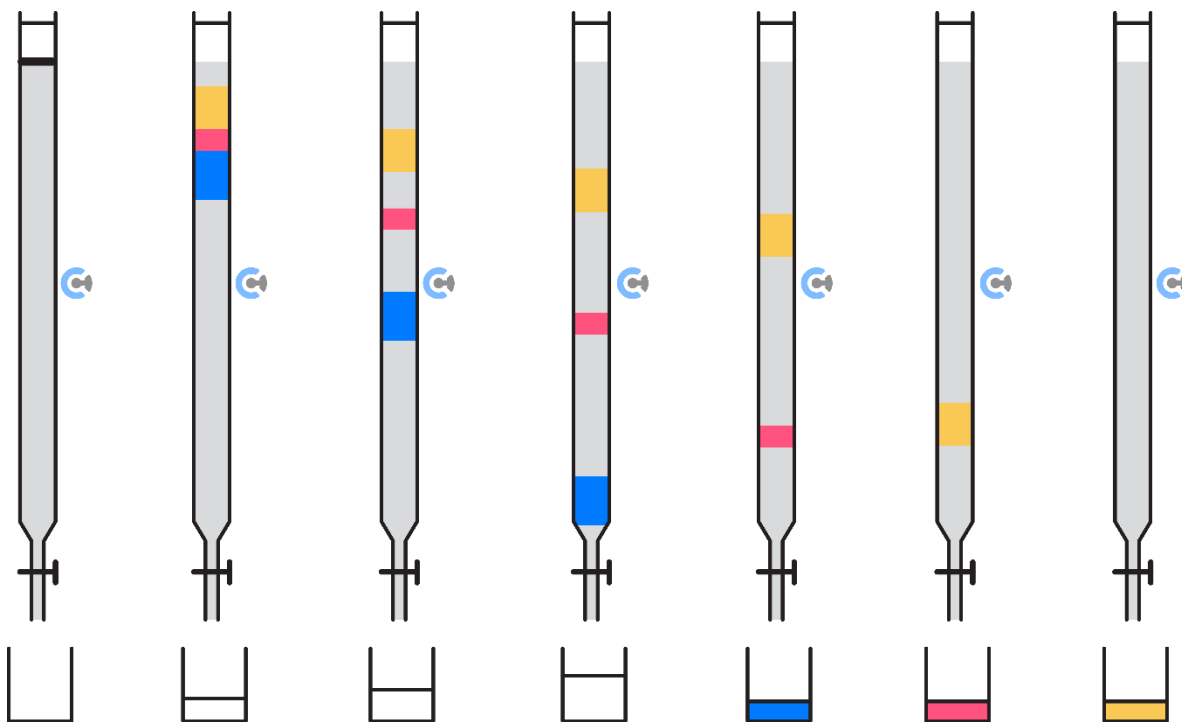
Indicate (by ticking) whether the following statements are **true** or **false**.

	True	False
a. The retardation factor is a value which can be used to measure how far a component travels in relation to the solvent front in HPLC.		
b. The finer the particles which make up the stationary phase in column chromatography, the longer the components will take to reach the end.		
c. Due to more frequent adsorption and desorption, high pressures are typically used in column chromatography to move components through faster.		
d. Polar components will have a higher retention time than non-polar components when a polar stationary phase is used.		
e. Column chromatography is more sensitive and allows for greater separation between components as compared to paper chromatography.		
f. HPLC can be used to do both qualitative and quantitative analysis.		
g. A calibration curve is used in order to establish the mass of a substance present in a sample based on its area under the peak.		
h. Extrapolation is preferred over interpolation since it is more accurate to establish values based on ratios rather than recorded data.		

Space for Personal Notes

Question 2 (8 marks)

In the chemistry lab, Ayaka is attempting to separate an unknown solution into its individual components, wanting to perform both qualitative and quantitative analysis on the sample. To do this, she uses a HPLC set up with a non-polar stationary phase. Below are the images she captures of her set-up as it progresses over time.



- a. Ayaka notices that her sample only separates into three components. Does this mean that there are only three components in the sample? Why or why not? (2 marks)

- b. Explain why components separate in a HPLC column. Make reference to both adsorption and desorption rates. (2 marks)

- c. Which component would be the most polar? (1 mark)

- d. After analysing the chromatograph, Ayaka wishes to determine the concentration of the component with the shortest retention time. She establishes the area under the curve as being 7 mm^2 . How can Akaya now find the concentration of this component, given its identity is still unknown? (3 marks)

Question 3 (3 marks)

Blake is revising for an upcoming chemistry SAC, and wishes to explore the differences between a typical column chromatograph and HPLC. He is aware of the following points but unsure why:

- HPLC allows for greater separation.
- HPLC requires the solvent to be pumped at high pressures.
- HPLC uses finer particles such as SiO_2 than normal column chromatography.

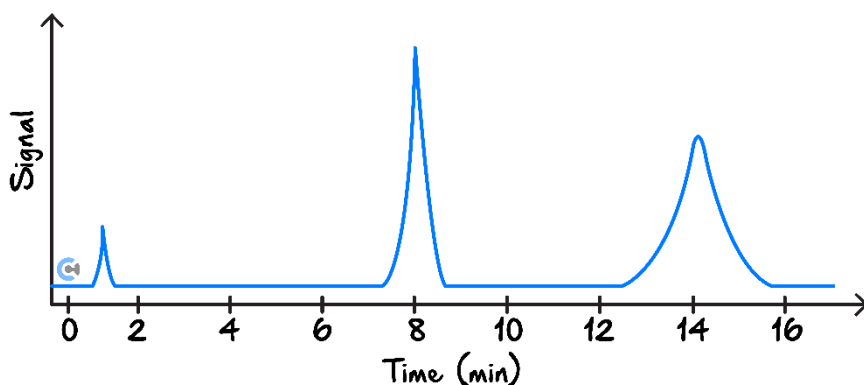
By comparing the two, provide an explanation for the aforementioned points.

Space for Personal Notes

Section B: Extension (5 Marks)

Question 4 (5 marks)

After running a sample of a red-coloured solution through a HPLC set up, a chemist records the following graph from the machine. The chemist noted using deionised water as the mobile phase.



- a. What is the retention time of the most polar compound? Support your answer with a relevant theory you have learned. (2 marks)

- b. The chemist hypothesises that the component with a retention time of 8 minutes is the vermilion pigment. To test this, the chemist adds some vermilion to the original sample and runs it back through the chromatograph. How would the graph change if the chemist's hypothesis was correct? (2 marks)

- c. In another lab, the chemist takes the same sample and is again left with three peaks. However, the retention time for each peak is considerably longer. Provide a possible reason as to why this is the case. (1 mark)



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