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VCE Chemistry ½

Principles of Chromatography [1.10]

Test Solutions

20 Marks. 1 Minute Reading. 16 Minutes Writing.

Results:

Test Questions	_____ / 15
Extension	_____ / 5

Section A: Test Questions (15 Marks)

Question 1 (4 marks)

Tick whether the following statements are **true** or **false**.

Statement	True	False
a. The mobile phase and stationary phase refer to periods of time.		✓
b. Polar components like alcohol will be more attracted to a mobile phase which is also polar such as hexane.		✓
c. Adsorption refers to a substance sticking to the outside of a solid surface, and desorption is when it is released from that solid surface.	✓	
d. Methane is an example of a polar compound whereas hydrochloric acid is an example of a non-polar compound.		✓
e. The solvent front refers to the highest distance that the water reaches in paper chromatography.	✓	
f. In qualitative analysis of a compound, if two components have a similar retardation factor under similar laboratory conditions, they are likely to be the same.	✓	
g. A high rate of travel of a component indicates that it has a strong attraction to the mobile phase.	✓	
h. If paper chromatography is conducted with water as the mobile phase, methane will travel a lesser distance up the paper than methanol.	✓	

Space for Personal Notes

Question 2 (6 marks)

In the Lab, Kanta is practising her chemistry skills by making a paper chromatography set-up. For her mobile phase, she uses ethanol from her storage. At the base of the paper, Kanta places three drops – A, B, and C – each of which is a different component.

a. Identify the mobile phase and the stationary phase in this set-up. (1 mark)

Mobile – Ethanol, Stationary – Paper.

b. What can be revealed about the polarity molecule C if it travels the furthest distance? Why? (2 marks)

If it travels the furthest it indicates that it is most strongly attracted to the mobile phase, which in this case is polar. Due to this we can say that molecule C is also the most polar, as like attracts like.

c. What can be revealed about the polarity of molecule A if it travels the least distance? Why? (2 marks)

If it travels the least it indicates that it is most strongly attracted to the stationary phase as it does not want to move, which in this case is non-polar. Due to this we can say that molecule C is also the most non-polar, as like attracts like.

d. Given that the solvent front reaches a distance of 10 cm, with component B travelling a distance of 5 cm, calculate the Rf value for this experiment. (1 mark)

0.5

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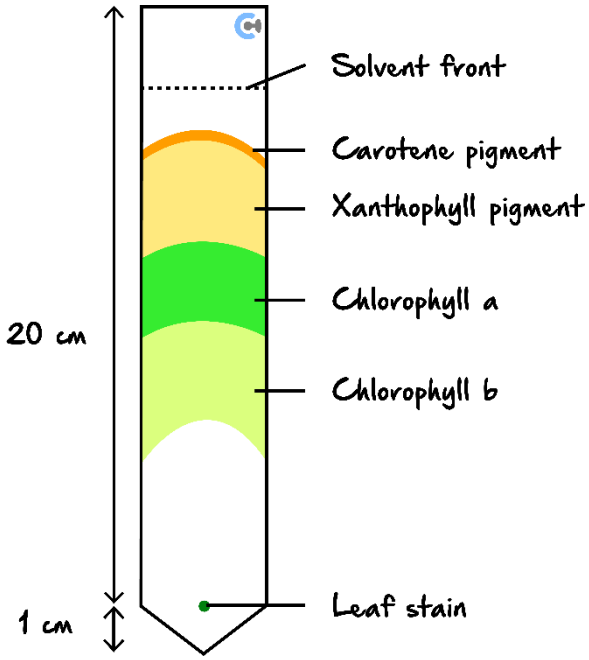
Question 3 (5 marks)

Late at night, Sia wonders what the different pigments are inside of a green leaf stain. She uses the following set-up using water as the mobile phase.



a. With reference to adsorption and desorption, explain the movement of the carotene pigment up the paper. (2 marks)

The carotene pigment adsorbs to the stationary phase, and desorbs onto the mobile phase in order to move up the paper. However, as it is at the top, its rate of desorption is higher than its rate of adsorption.

b. What is likely the polarity of Chlorophyll b? (1 mark)

Non-polar

c. Given that Sia was under pressure to get better results, name and explain a way in which she could have seen more separation of the pigments. (2 marks)

She could have used a longer piece of paper, and waited for a great amount of time.
This would allow each component to undergo more adsorption and desorption which would cause a greater degree of separation across the longer paper.

Section B: Extension (5 Marks)

Question 4 (5 marks)

After cramming for his test late at night, Arjun forgets how the experimental procedure for chromatography works.

a. Help Arjun re-arrange the following steps in the correct order. (1 mark)

1) Record the distance travelled by each component.

2) Place a drop of the mixed substance on the base of the paper.

3) Calculate the Rf value of each component.

4) Place the paper into a solution of water.

2, 4, 1, 3

b. Explain why Rf value is calculated and how it can be used as an experimenter to identify a compound in a mixture. (2 marks)

The Rf value is calculated by the experimenter as measure of how far a component has travelled as compared to the solvent front. It is used as a means of comparison between components, in order to identify what a specific component is, if it has the same Rf value under similar laboratory conditions.

c. Identify two situations in which the calculated Rf value may not be able to be used in order to identify a compound. (2 marks)

The set up needs to be conducted at the same laboratory conditions.
The set up needs to use the same mobile phase and the same stationary phase.
The same experimental equipment needs to be used.
Without these comparison of the Rf values it is inaccurate.

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