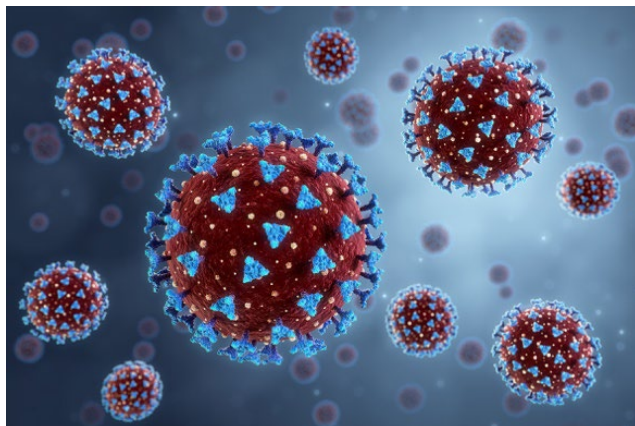


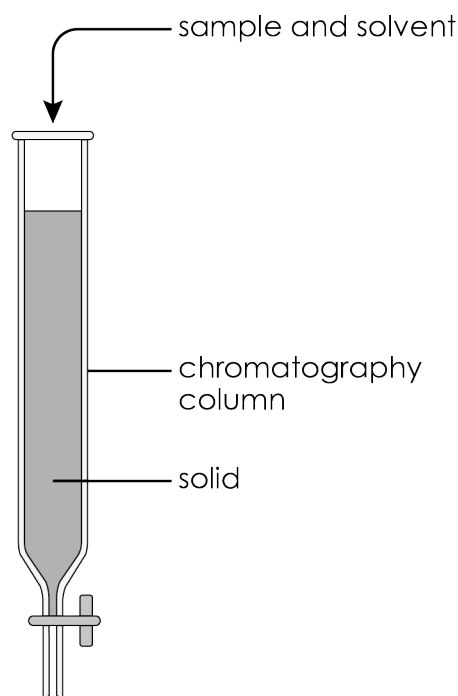
Chromatography

The image shows a COVID-19 virus under the microscope. The spikes on the surface are protein molecules. These protein spikes enable the virus to enter cells.



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When scientists were developing COVID-19 vaccines, they needed to identify the spike protein on the virus. They used a special type of chromatography called liquid chromatography.



1 In liquid chromatography, the sample is added to a solvent and allowed to filter down a column packed with a solid.

(a) Name the stationary phase.

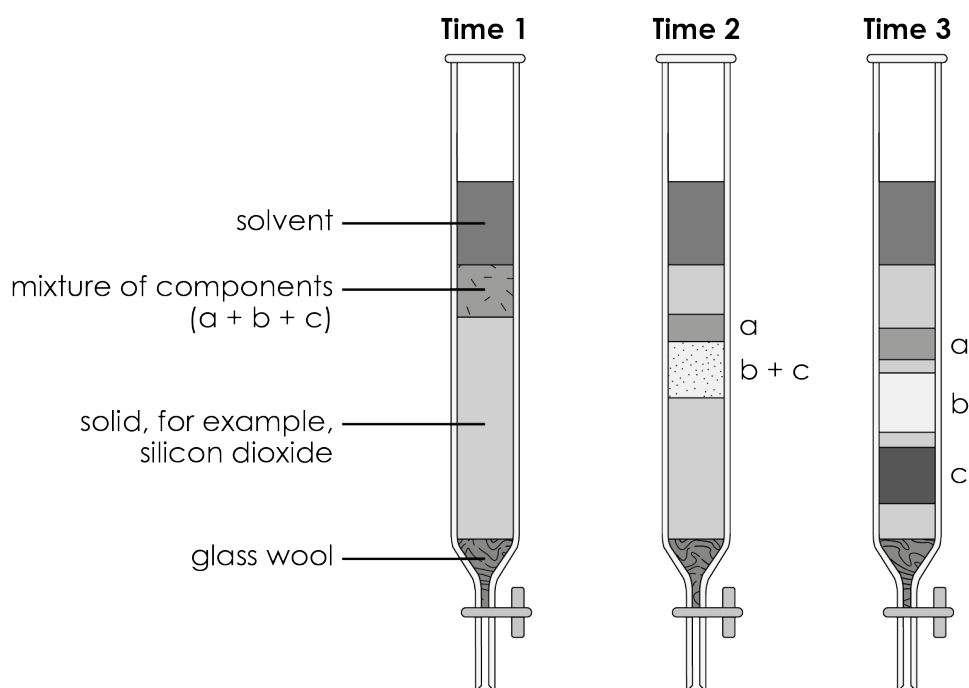
(b) Name the mobile phase.

(c) Which statement explains why different components in the sample travel down the column at different rates? Circle the correct answer.

- A. All the components have the same attraction to the stationary phase.
- B. All the components have the same attraction to the mobile phase.
- C. All the components have the same attraction to both mobile and stationary phases.
- D. Different components have different attractions to the mobile and stationary phases.

2 The different components in the sample mixture move down the column and filter through the solid at different speeds.

The diagram shows how liquid chromatography works (**Time 1**, **Time 2** and **Time 3** represent the changes in the chromatography column over time).



(a) Describe what is happening to the mixture of components at:

i. **Time 1**

ii. **Time 2**

iii. Time 3.

(b) Suggest how scientists can collect pure samples of components **a**, **b** and **c**.

(c) Give two ways in which liquid chromatography differs from paper chromatography.

1. _____

2. _____

(d) R_f values are also used in liquid chromatography. Complete the table to calculate the R_f values for components **a**, **b** and **c**. Give your answers to two significant figures.

Component	Distance moved by component/cm	Distance moved by solvent/cm	R_f value
a	3	21	
b	10	21	
c	15	21	

3 Spike proteins on the COVID-19 virus were separated from the rest of the virus and broken up (digested) into smaller parts (peptides). The mixture of peptides is then separated by chromatography.

(a) Describe how liquid chromatography was used to separate the mixture of peptides into pure peptides.

(b) Scientists then used instrumental methods to identify the peptides. Give two reasons why instrumental methods were used rather than chemical tests.

1. _____
2. _____



Which question(s) did you get wrong? Why?

What will you do next time you're asked a similar question?