

Electrophoresis worksheet

A Reading

Electrophoresis is a commonly used laboratory method for the separation, identification, and quantification of molecules of large molecular size. Common applications of electrophoresis include serum proteins, isoenzyme analysis, lipoprotein analysis, and so on.

Electrophoresis means the movement of charged molecules or ions in an electric field with the practical addition that subsequent detection of molecules is possible.

The most common form of electrophoresis performed in the clinical laboratory uses buffered agarose or cellulose acetate as the media.

Most molecules separated by electrophoresis contain both positive and negative charges. These molecules are called zwitterions.

The direction of migration of a protein in an electric field depends on the pH of the buffer and the isoelectric point of the protein. The isoelectric point is defined as the pH at which the sum of all positive and negative charges on the molecule adds up to zero. A protein at its isoelectric point has no charge and will not migrate in an electric field. At a pH below the isoelectric point, the protein has a positive charge and will therefore migrate toward the cathode. At a pH above the isoelectric point, the protein will migrate toward the anode.

Other factors that influence the migration of proteins in an electric field are the size and shape of the molecules, the strength of the electric field, temperature, and pore properties of the electrophoresis medium.

Detection method

Different stains for serum proteins are available, for example Coomassie blue. Gold or silver are 100 times more sensitive than Coomassie stain.

The equipment of the electrophoretic separation system comprises a power source, an electrophoretic chamber and, in some cases, a densitometer. The power source may regulate the potential difference between the cathode and the anode by constant voltage or constant current.

Quantitation of the electrophoretogram by densitometry

A densitometer is a comparator. It compares the amount of light that passes through a sample to the amount that passes through in the absence of a sample. Densitometry has much in common with spectrophotometry or filter photometry except that in densitometry, a material in a solid phase is detected as opposed to a liquid sample in a cuvette.

Read the text and decide if the statements are true or false.

- 1 Electrophoresis is used for all molecules sizes.
- 2 Electrophoresis consists in movement of charged molecules in an electric field.
- 3 Buffered agarose is more common as the medium than cellulose acetate.
- 4 Zwitterions have no electric charge.
- 5 Protein movement relies mainly on the pH of the buffer.
- 6 The isoelectric point is a sum of all electric charges on the molecule.
- 7 A protein can move either to the cathode or the anode.
- 8 Coomassie stain are less sensitive than gold.
- 9 Densitometry is completely different from spectrophotometry.
- 10 Densitometry is used for identifying solid materials.

B Grammar

Past simple

5.2 Complete the sentences using the following verbs in the correct form:

buy catch cost fall hurt sell spend teach throw write

- 1 Mozart wrote more than 600 pieces of music.
- 2 'How did you learn to drive?' 'My father _____ me.'
- 3 We couldn't afford to keep our car, so we _____ it.
- 4 Dave _____ down the stairs this morning and _____ his leg.
- 5 Joe _____ the ball to Sue, who _____ it.
- 6 Ann _____ a lot of money yesterday. She _____ a dress which _____ £100.

5.3 You ask James about his holiday. Write your questions.

Hi. How are things?

Fine, thanks. I've just had a great holiday.

1 Where did you go ?

To the U.S. We went on a trip from San Francisco to Denver.

2 How _____ ? By car?

Yes, we hired a car in San Francisco.

3 It's a long way to drive. How long _____ to get to Denver?

Two weeks.

4 Where _____ ? In hotels?

Yes, small hotels or motels.

5 _____ good?

Yes, but it was very hot – sometimes too hot.

6 _____ the Grand Canyon?

Of course. It was wonderful.

5.4 Complete the sentences. Put the verb into the correct form, positive or negative.

1 It was warm, so I took off my coat. (take)

2 The film wasn't very good. I didn't enjoy it much. (enjoy)

3 I knew Sarah was busy, so I _____ her. (disturb)

4 We were very tired, so we _____ the party early. (leave)

5 The bed was very uncomfortable. I _____ well. (sleep)

6 The window was open and a bird _____ into the room. (fly)

7 The hotel wasn't very expensive. It _____ much to stay there. (cost)

8 I was in a hurry, so I _____ time to phone you. (have)

9 It was hard carrying the bags. They _____ very heavy. (be)

Past continuous

6.1 What were you doing at these times? Write sentences as in the examples. The past continuous is not always necessary (see the second example).

1 (at 8 o'clock yesterday evening) I was having dinner.

2 (at 5 o'clock last Monday) I was on a bus on my way home.

3 (at 10.15 yesterday morning) _____

4 (at 4.30 this morning) _____

5 (at 7.45 yesterday evening) _____

6 (half an hour ago) _____

6.2 Use your own ideas to complete the sentences. Use the past continuous.

1 Matt phoned while we were having dinner.

2 The doorbell rang while I _____.

3 The car began to make a strange noise when we _____.

4 Jessica fell asleep while she _____.

5 The television was on, but nobody _____.

Past simple and continuous

6.4 Put the verb into the correct form, past continuous or past simple.

1 Jenny was waiting (wait) for me when I arrived (arrive).

2 'What _____ (you / do) at this time yesterday?' 'I was asleep.'

3 '_____ (you / go) out last night?' 'No, I was too tired.'

4 How fast _____ (you / drive) when the accident _____ (happen)?

5 Sam _____ (take) a picture of me while I _____ (not / look).

6 We were in a very difficult position. We _____ (not / know) what to do.

7 I haven't seen Alan for ages. When I last _____ (see) him, he _____ (try) to find a job.

8 I _____ (walk) along the street when suddenly I _____ (hear) footsteps behind me. Somebody _____ (follow) me. I was scared and I _____ (start) to run.

9 When I was young, I _____ (want) to be a pilot.

10 Last night I _____ (drop) a plate when I _____ (do) the washing-up. Fortunately it _____ (not / break).