

Part A

CCT Weekly Practice Science

Unit 1 – Retrosynthesis

Retrosynthesis is a method of chemical synthesis which involves “deconstructing” a target molecule into its readily available, simple starting materials in order to assess the best synthetic route. This is achieved by breaking the bonds of the target molecular structure into constituent fragments, known as synthons, and by conversion of functional groups into others, known as functional group interconversions.

The concept of retrosynthesis was framed and formalized by Elias James Corey, for which he won the Nobel Prize for Chemistry in 1990. Prior to this method becoming the standard practice, there was no formalized approach to organic chemical synthesis, and many methods involved significant trial and error with available simple molecules. By beginning with the target molecule, retrosynthesis allows chemists to work “in reverse”, by breaking up the complex target structure to arrive at the simple precursors. Often, there will be more than one possible synthetic route and retrosynthesis helps in discovering these routes and comparing them in terms of the cost, simplicity and feasibility of using different reagents and intermediates. In doing so, the most favourable, efficient route can be chosen before synthesis is started on an industrial scale.

Source: www.iqvia.com

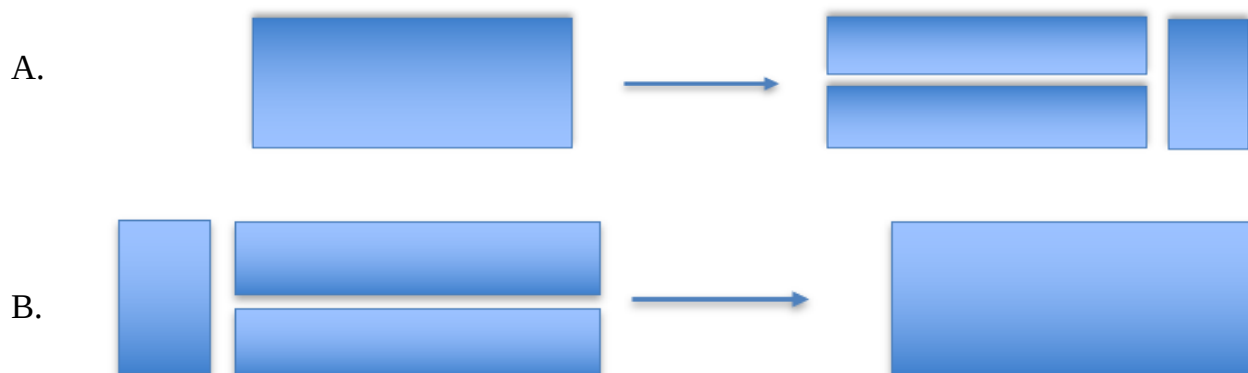
Question 1:-

Which of the following is ALWAYS true about retrosynthesis?

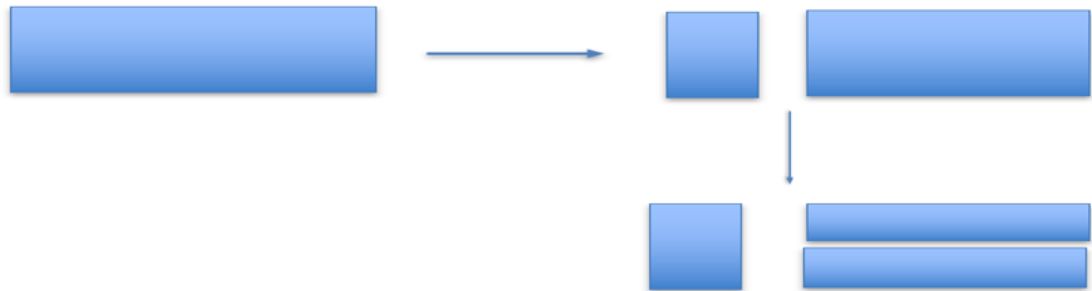
- A. It helps in reducing the cost of synthesizing a complex organic molecule
- B. Synthons are readily available chemicals which can help in retrosynthesis
- C. Intermediate compounds are formulated during retrosynthesis
- D. Retrosynthesis helps in finding out the unique precursor that helps in building a complex organic molecule.

Question 2:-

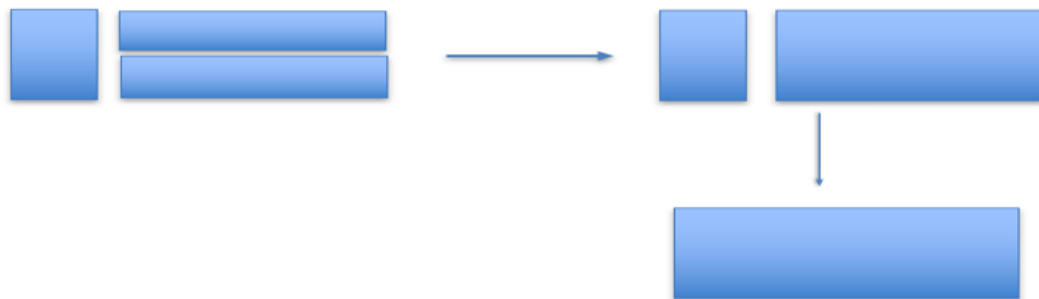
Which of the following diagrams BEST represents the essence of retrosynthesis?



C.



D.



Unit 2 – Nerve Impulses

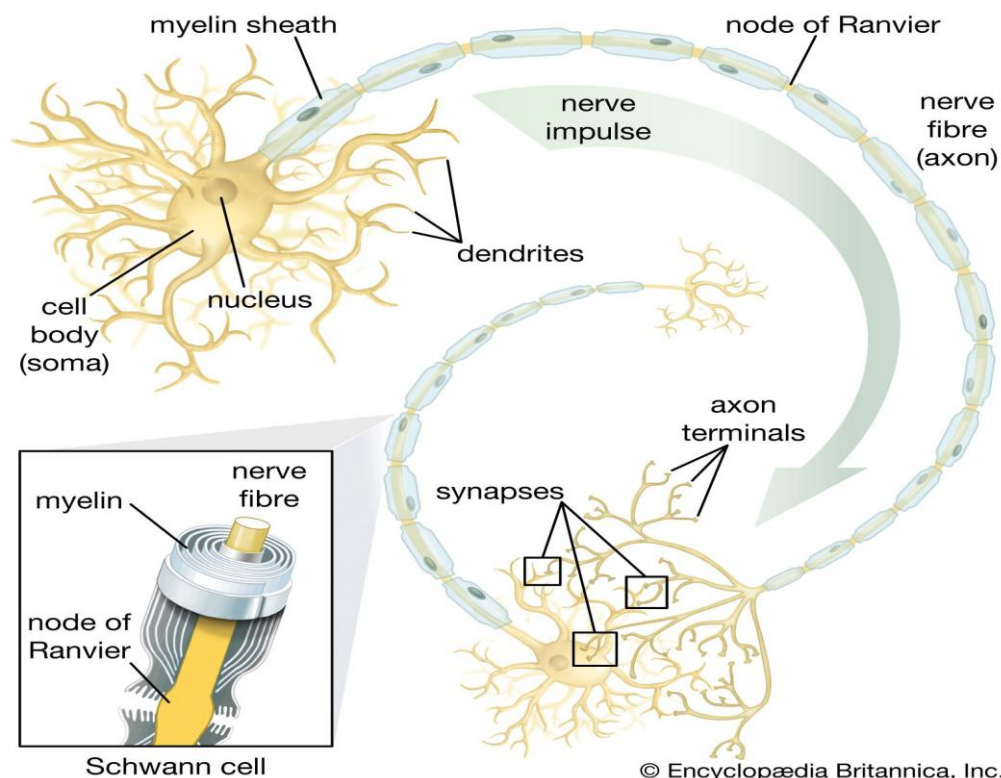


Image: Motor Neuron

The smallest unit of the nervous system is called a neuron, which consists of a cell body, soma that is attached to a long nerve fibre called the axon. A neuron typically has one axon that connects it with other neurons or with muscle or gland cells. Some axons may be quite long, reaching, for example, from the spinal cord down to a toe.

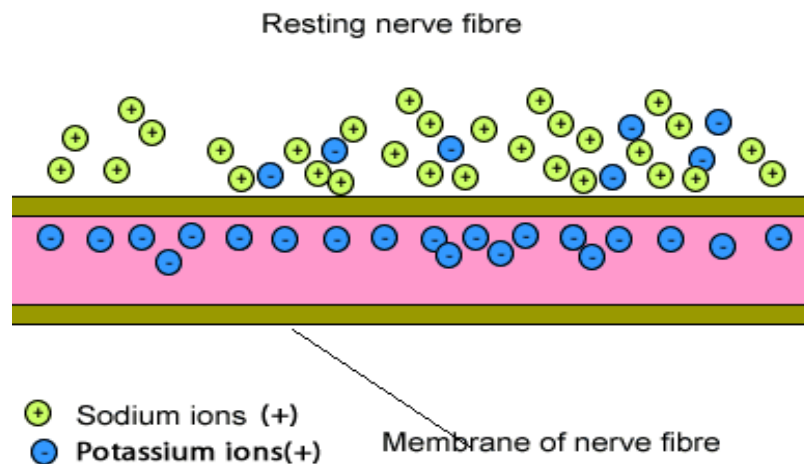
The axon carries nerve impulses away from the cell body. Most axons of vertebrates are enclosed in a myelin sheath, which increases the speed of impulse transmission; some large axons may transmit impulses at speeds up to 90 metres (300 feet) per second.

Source URL: <https://www.britannica.com/science/axon/images-videos#/media/1/46342/66776>

Question 3:-

The axon of one neuron connects with the soma of another neuron. This junction is referred to as:

- A. Node of Ranvier
- B. Dendrite
- C. Synapse
- D. Myelin



“Just like a telephone cable the neuron conducts a signal as an electrical impulse. The electrical impulse is generated by creating an imbalance of positive and negative charges across the axon's membrane. When the axon is resting there are unequal concentrations of ions (charged atoms) both inside and outside of the axon. High concentrations of positive ions exist outside the axon while low concentrations of positive ions exist on the inside.

When a signal arrives at the axon, changes to the membrane take place that make it permeable to positive ions (sodium ions). As a result sodium ions flood into the axon and release a small amount of electrical energy. This causes the membrane just ahead of the signal to become permeable to sodium ions. This continues along the length of the axon. As soon as the sodium ions enter the axon they are pumped out of the axon and the membrane becomes impermeable to

sodium ions once again at the site just behind the signal. The animation above shows the sequence of events related to the transmission of the electrical signal along the axon.”

Source: <http://www.dynamicscience.com.au/tester/solutions1/biology/nervoussystem/impulse.htm>

Question 4:-

When an axon is at rest, positive ions are.....

- A. present only outside an axon.
- B. present only inside an axon.
- C. present both inside and outside an axon.
- D. not present on either side of an axon.

Question 5:-

When an impulse travels along the length of an axon, which of the following does **NOT** occur?

- A. There is an influx of sodium ions into the axon.
- B. A difference in potential exists between either side of the membrane.
- C. The membrane potential remains in a state of equilibrium throughout.
- D. There is an influx of potassium ions into the axon.

Source of questions:

Centre for Teacher Accreditation (CENTA[®]) – m.centa.org

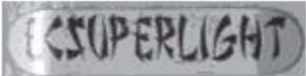
Part B

SKATEBOARD

Javed is a great skateboard fan. He visits a shop named SKATERS to check some prices.

At this shop you can buy a complete board. Or you can buy a deck, a set of 4 wheels, a set of 2 trucks and a set of hardware, and assemble your own board.

The prices for the shop's products are:

Product	Price in zeds	
Complete skateboard	82 or 84	
Deck	40, 60 or 65	
One set of 4 Wheels	14 or 36	
One set of 2 Trucks	16	
One set of hardware (bearings, rubber pads, bolts and nuts)	10 or 20	

QUESTION 4: Javed wants to assemble his own skateboard. What is the minimum price and the maximum price in this shop for self-assembled skateboards?

- A. Minimum price:..... zeds.
- B. Maximum price: zeds.

QUESTION 5: The shop offers three different decks, two different sets of wheels and two different sets of hardware. There is only one choice for a set of trucks.

How many different skateboards can Javed construct?

- A. 6
- B. 8
- C. 10
- D. 12

QUESTION 6: Javed has 120 zeds to spend and wants to buy the most expensive skateboard he can afford.

How much money can Javed afford to spend on each of the 4 parts? Put your answer in the table below.

Part	Amount (zeds)
Deck	
Wheels	
Trucks	
Hardware	

Part A

CCT Weekly Practice Science

Answers

1. Option D: CORRECT. Intermediate compounds are generated while doing retrosynthesis of a complex organic molecule. These help us in finding simple precursors that are required for the synthesis.
2. Option C: CORRECT. The rectangle is deconstructed into smaller units in two steps. It also represents the existence of intermediate compounds similar to retrosynthesis.
3. Option B: CORRECT. The student has correctly linked the text to the image and understood the image. While the text only talks about the connection between neurons, the image shows two neurons connected to each other, forming a synapse in between.
4. Option A: CORRECT. Despite having positive ions (Sodium and Potassium) both inside and outside the axon, the student has correctly identified that there is a higher concentration of positive ions outside compared to the inside. This makes the relative charge inside the axon negative.
5. Option C: CORRECT. This is a correct statement, because an electrical impulse is only generated due to an “imbalance of the charges”. Equilibrium on the other hand refers to a balance of charges.

Science Set 4, Unit 2, Item #3**Correct Option: C**

Option A: incorrect. This statement is true because sodium ions do enter the axon as shown in the animation as well as the text.

Option B: incorrect. This statement is also true. This indicates a misconception that “imbalance of positive and negative charges across the axon's membrane” is being considered to be the same as potential difference.

Option C: CORRECT. This is a correct statement, because an electrical impulse is only generated due to an “imbalance of the charges”. Equilibrium on the other hand refers to a balance of charges.

Option D: incorrect. According to the image, although potassium ions are present outside the axon, these do not cross through the membrane. The student has misinterpreted the animation.

The solution for Part B is explained in Video Solution.