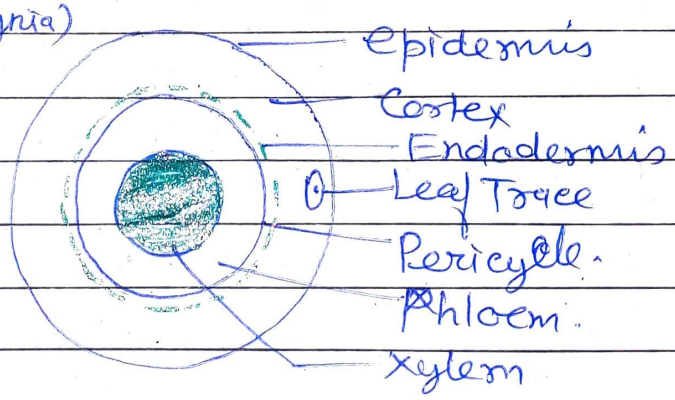
Protostele and its type :-

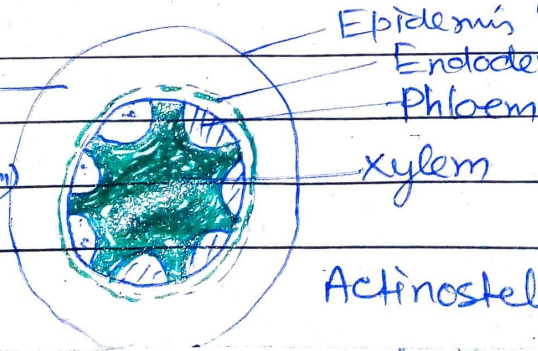
It is a non medullated stele consisting of a central core of xylem surrounded by a band of phloem. There is a single or multiple layer of pericycle outside the phloem which is delimited externally by a continuous sheath of endodermis. The following types of protosteles are recognized in pteridophytes.

[I] - Haplostele - This is most primitive type consist of a solid xylem core with smooth circular out line. with surroundings of Phloem (ie - Rhynia)



Protostele.

[II] - Actinostele - In this type of Protostele the xylem is star shaped with many radiating arms. Phloem is present in small patches in between the radiating arms of xylem.

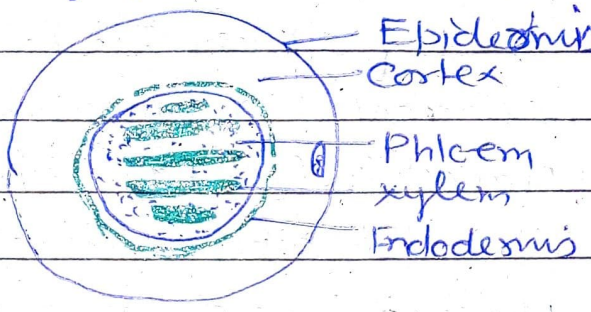


(ie - Lycopodium serratum)

Actinostele -

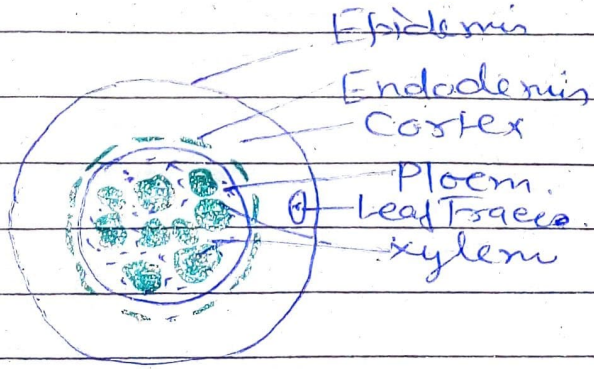
[III] Plectostele =

In this protostele, the central xylem core breaks in to more or less parallel plates is known as plectostele. in which each xylem plate surrounded by phloem. (Lycopodium elavatum)



(Plectostele.)

[IV] Mixed Protostele - Sometimes the solid xylem core of the protostele is broken in to small groups of tracheids which remain embeded in the phloem. (ie - lycopodium cernum).



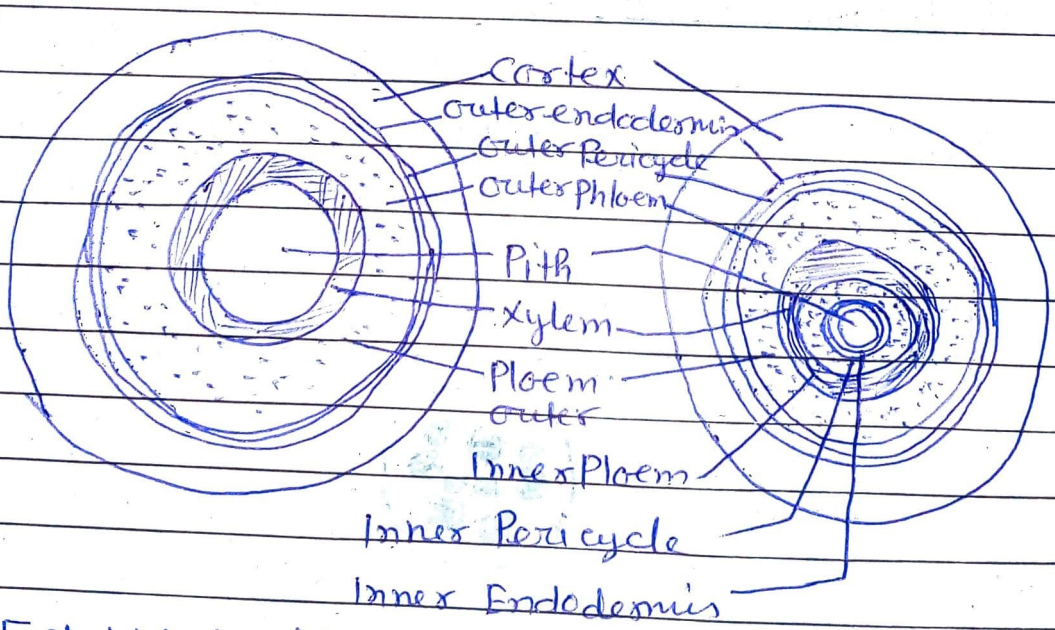
(Mixed Stele)

Siphonostele = A simple protostele is sufficient to meet the requirments of a small stem or a few larger ones under certain circumstances. However the increasing diameter of

the stem is met with by certain internal modifications in the stele. The first step in this direction is the appearance of definite parenchymatous pith or medulla in the centre of protostele.

If siphonostele have a single phloem ring external to xylem such stele is called ectophloic siphostele. (ie. Equisetum, Osmunda).

The siphonostele of Adiantum, Dryopteris and Marsilea have a ring of phloem each external and internal to the xylem. This type of siphonostele is called amphiphloic siphonostele.



Ectophloic siphonostele. Amphiphloic siphonostele