SNS COLLEGE OF PHARMACY AND HEALTH SCIENCES

Affiliated To The Tamil Nadu Dr. MGR Medical University, Chennai
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Coimbatore -641035

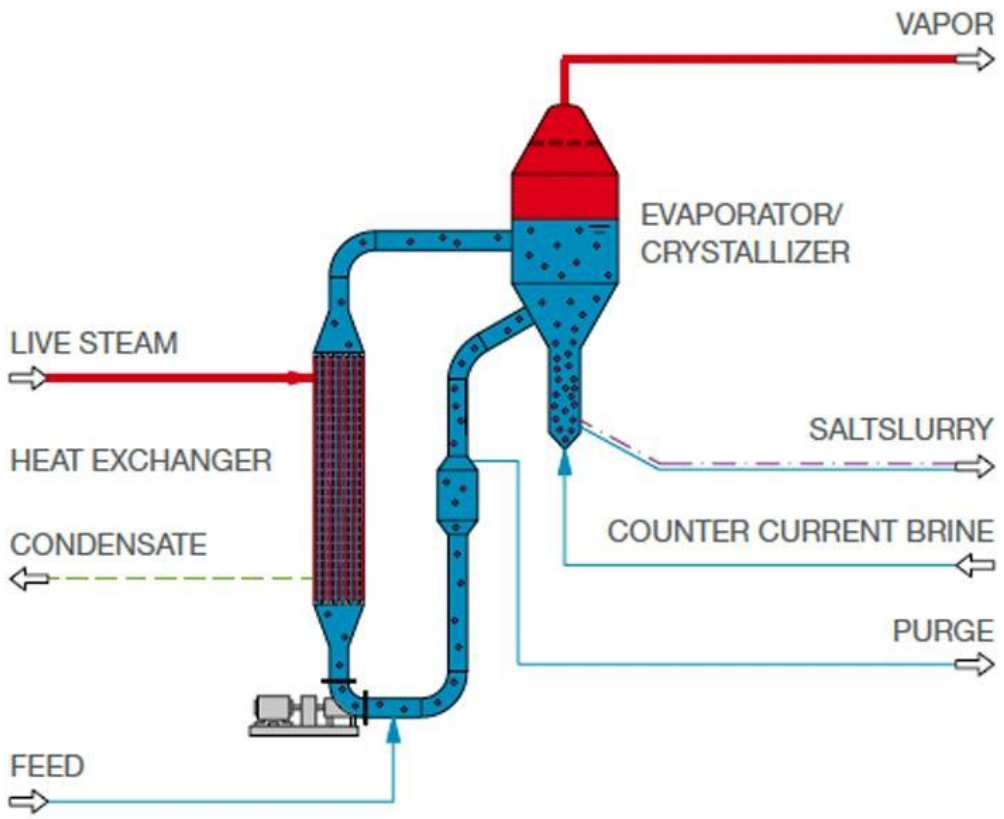
COURSE NAME : PHARMACEUTICAL ENGINEERING (BP404 T)

III SEM / II YEAR

TOPIC 5 : EVAPORATION

SUBTOPIC: FORCED CIRCULATION EVAPORATOR, MULTIPLE EFFECT EVAPORATOR AND ECONOMY OF MULTIPLE EFFECT EVAPORATOR

FORCED CIRCULATION EVAPORATOR



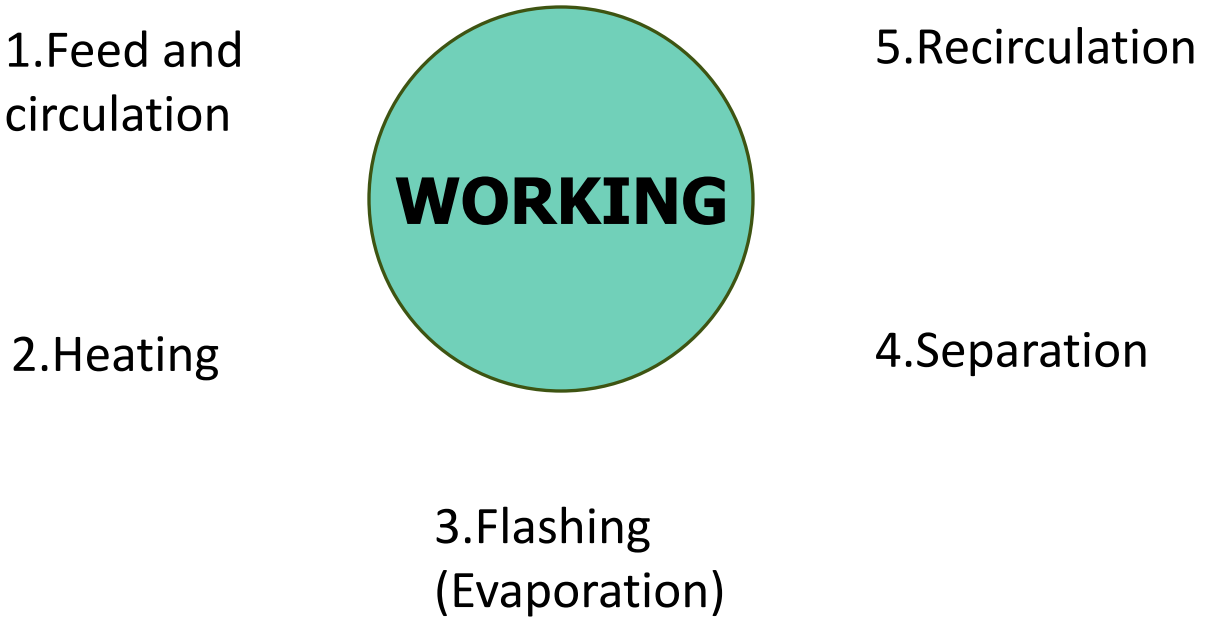
Principle:

Feed inlet → Pump → Heat Exchanger → Vapor-Liquid Separator → Vapor outlet

↓

Concentrated liquid outlet

Working:


1.Feed and circulation
WORKING
5.Recirculation
2.Heating
4.Separation
3.Flashing (Evaporation)

COMPONENTS

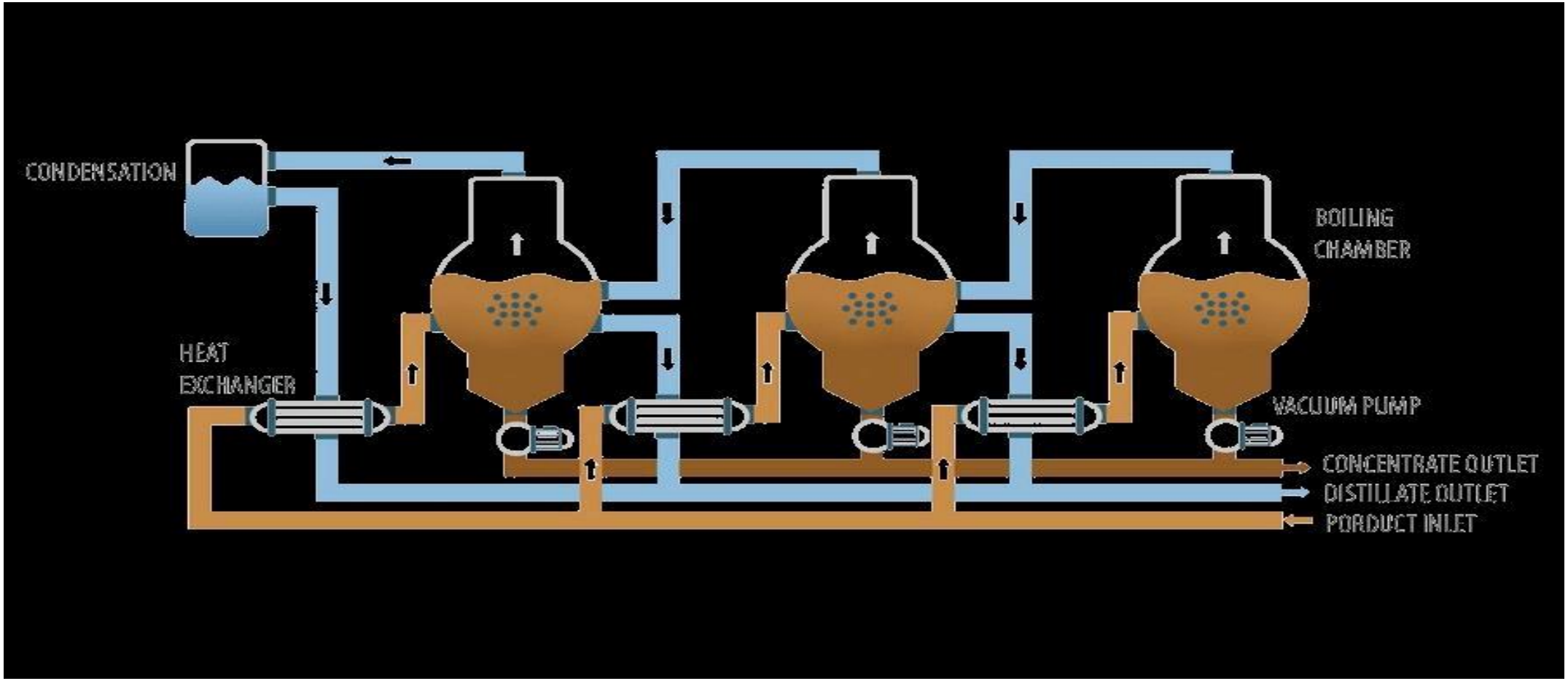
- Heat Exchanger (Calandria),
- Circulation Pump, and
- Separator (Vapour Head)

Components and functions of forced circulation evaporator

FUNCTIONS

- Enhance heat transfer, prevent fouling/scaling
- Handle difficult liquids (viscous/fouling)
- Achieve high concentration ratios with uniform heating.

MULTIPLE EFFECT EVAPORATOR



Principle:

Effect 1: Feed inlet → Heat Exchanger → Vapor-Liquid Separator → Vapor to Effect 2

↓

Concentrated liquid to Effect 2

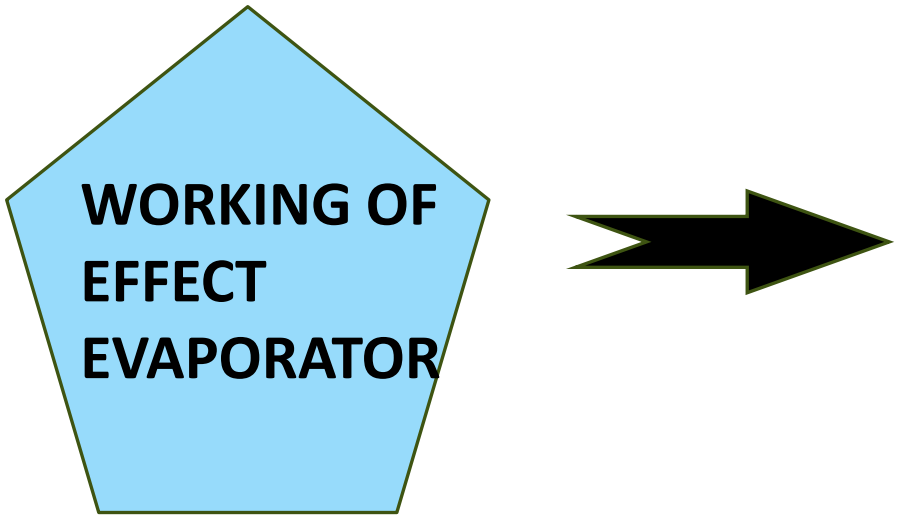
Effect 2: Feed inlet → Heat Exchanger → Vapor-Liquid Separator → Vapor to Effect 3

↓

Concentrated liquid to Effect 3

Effect 3: ...and same as effect 1 and 2...

Working:



1.Steam Introduction
2.Vapor Reuse
3.Cascading Effect
4.Series Operation
5.Concentration

Components and applications of multiple effect evaporator

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COMPONENTS

- Feed Tanks & Pumps
- Evaporation Chambers (Calandrias)
- Vapor Separators
- Condensers
- A Vacuum System

APPLICATIONS

- Food & beverage (juices, dairy)
- chemical processing
- Pharmaceuticals
- Textiles
- crucial for wastewater treatment

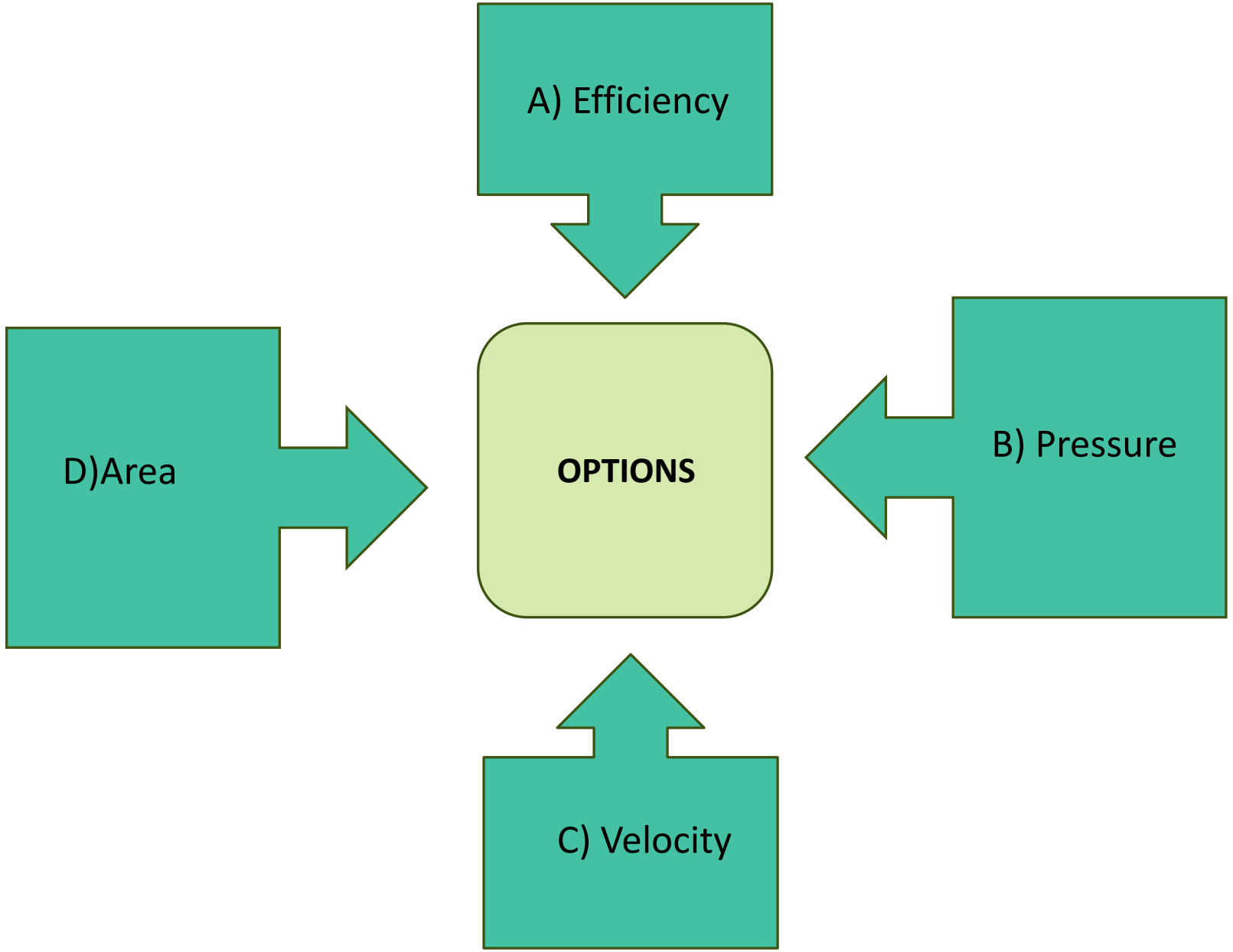
In multiple effect evaporator, one unit of steam produces vapour many times, depending on the number of evaporators connected. Hence,

$$\text{Economy of multiple effect evaporator} = \frac{\text{N units of vapor produced}}{\text{1 units of steam supplied}} = N$$

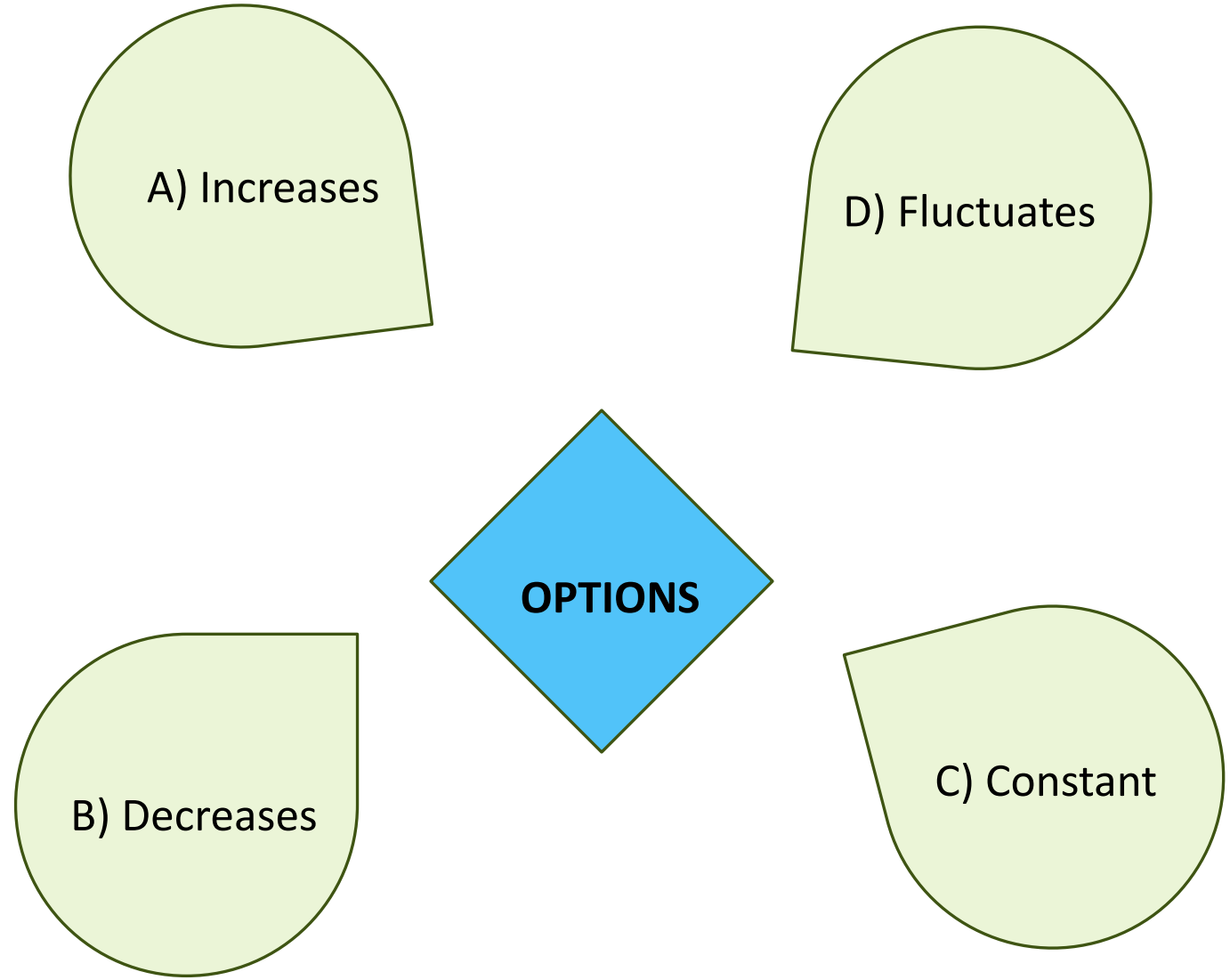
Therefore, the economy of the multiple effect evaporator is N times the economy of single effect evaporator

ASSESMENT

1.The primary goal of using multiple effects is to improve thermal_____.


A) Efficiency
D)Area
OPTIONS
B) Pressure
C) Velocity

2.In MEE, pressure generally _____ from first to last effect.


A) Increases
D) Fluctuates
OPTIONS
B) Decreases
C) Constant

REFERENCES

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2. Joseph R. Robinson: Sustained and Controlled Release Drug Delivery Systems, First edition, Volume 6, Marcel Dekker, Inc,1986,pg.618.

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5. https://www.scribd.com/document/668313752/Controlled-and-Novel-Drug-Delivery-by-N-K-Jain-1st-Editn-Reprint


THANK YOU