SNS COLLEGE OF PHARMACY AND HEALTH SCIENCES

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

Approved by Pharmacy Council of India, New Delhi.

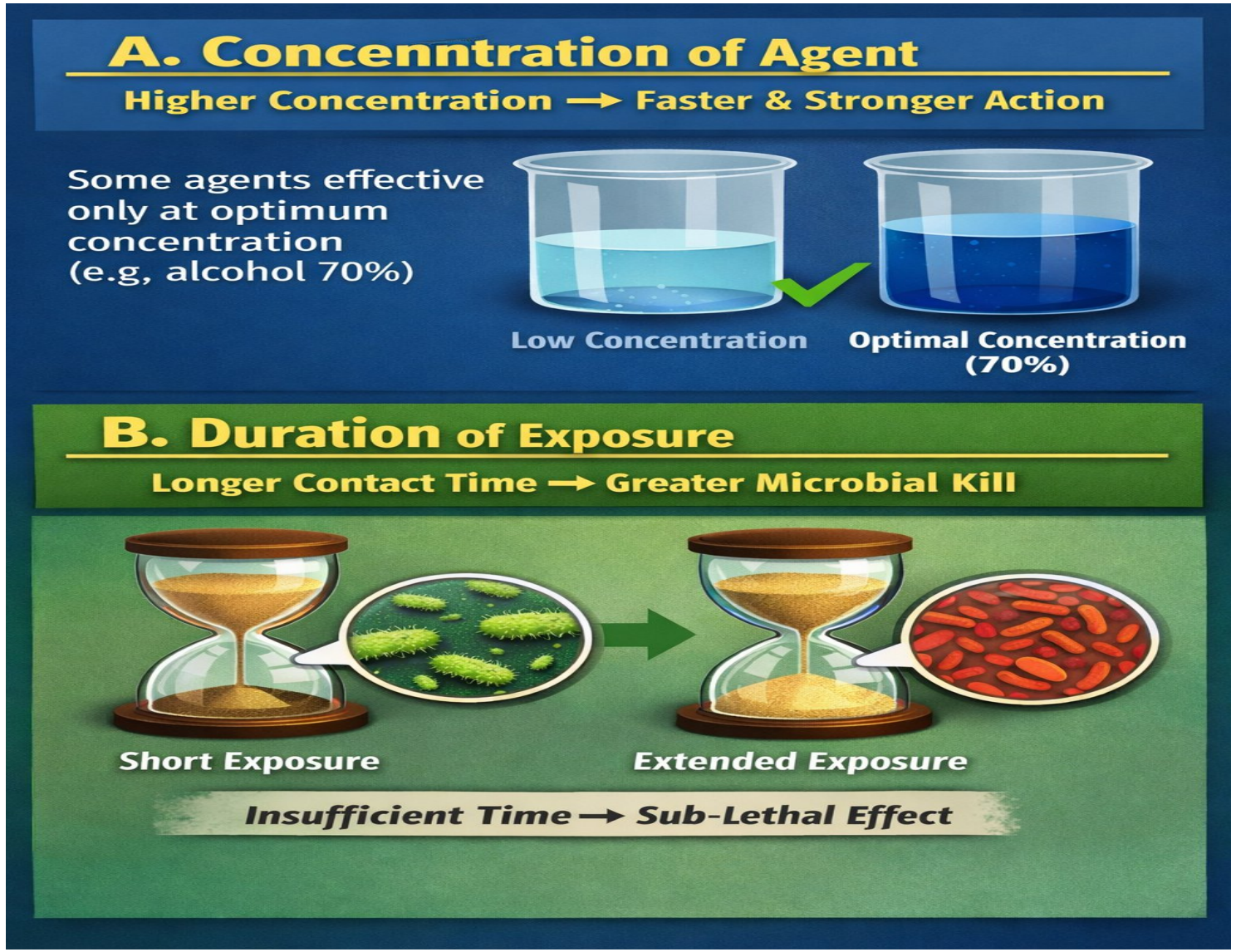
Coimbatore -641035

COURSE NAME : PHARMACEUTICAL MICROBIOLOGY - BP303 T

B.PHARM II YEAR / III SEM

UNIT 3

SUB TOPIC :FACTORS INFLUENCING DISINFECTION, ANTISEPTICS AND THEIR EVALUATION


A. Concenntration of Agent
Higher Concentration → Faster & Stronger Action
Some agents effective only at optimum concentration (e.g, alcohol 70%)
Low Concentration
Optimal Concentration (70%)
B. Duration of Exposure
Longer Contact Time → Greater Microbial Kill
Short Exposure
Extended Exposure
Insufficient Time → Sub-Lethal Effect

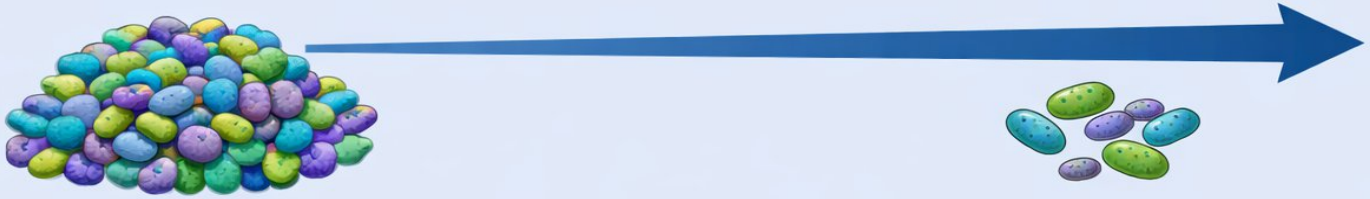
C. Type of Microorganism

Most Resistant → Least Resistant

Spores | Mycobacteria | Gram-Negative | Gram-Positive | Fungi | Viruses

D. Microbial Load

Higher Number of Organisms ↓ Reduced Effectiveness



High Microbial Load — Low Microbial Load

E. Presence of Organic Matter

Blood, Pus, Feces, Proteins reduce activity

Especially affects Halogens & Phenolics

F. Temperature

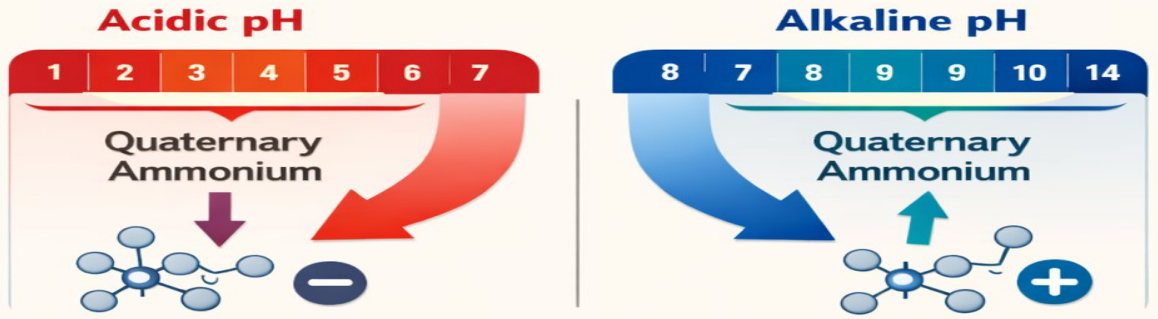
Higher Temperature → Increased Killing Rate

Excess Heat may Inactivate Some Disinfectants

G. pH of Medium

Acidic or alkaline pH alters ionization & activity

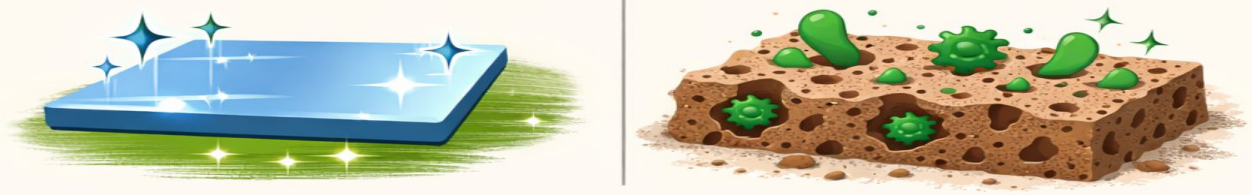
Example: Quaternary ammonium compounds ↓ in acidic pH



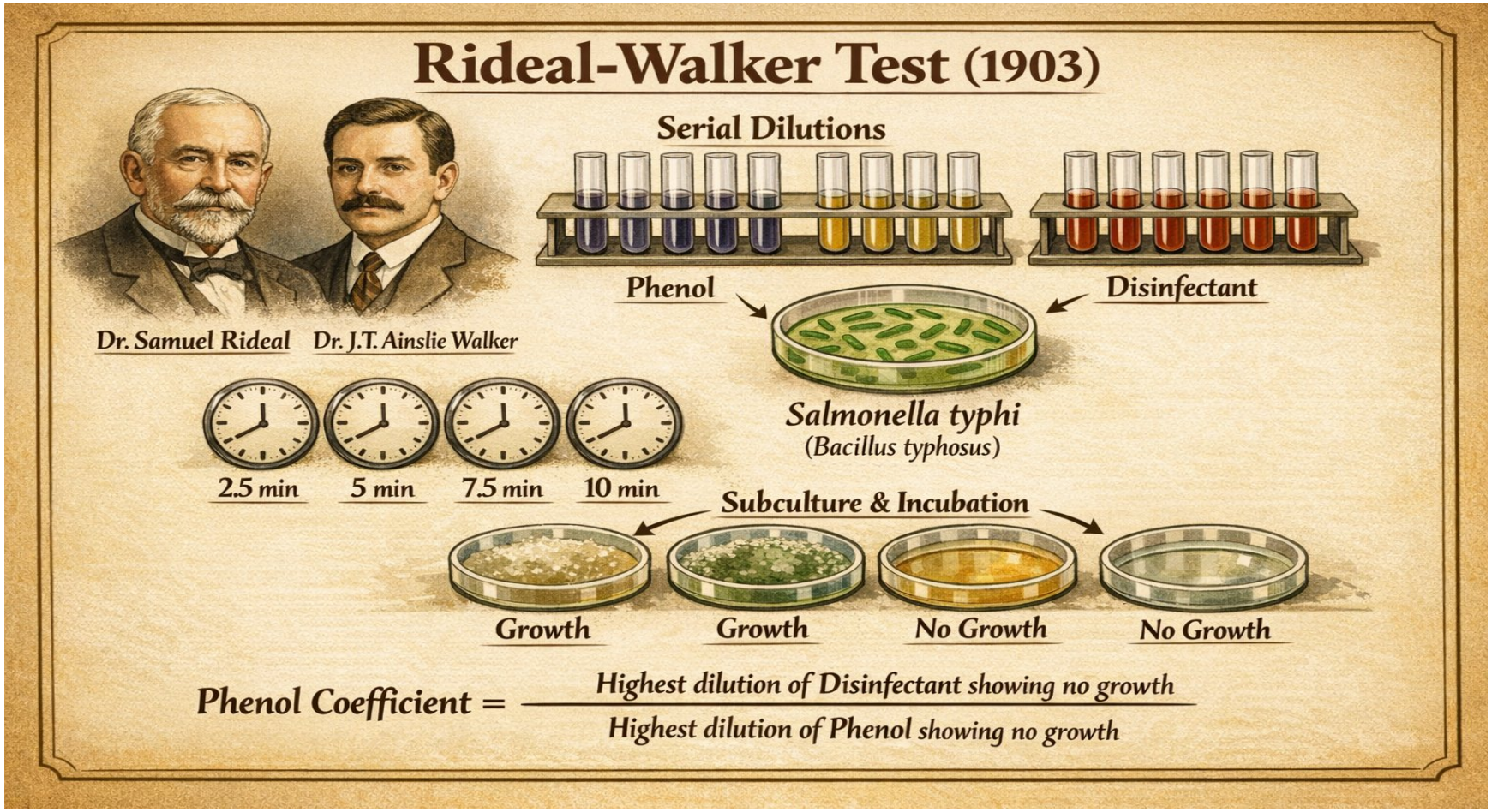
H. Nature of Surface

Smooth surfaces → Better Action

Porous surfaces → Reduced Penetration



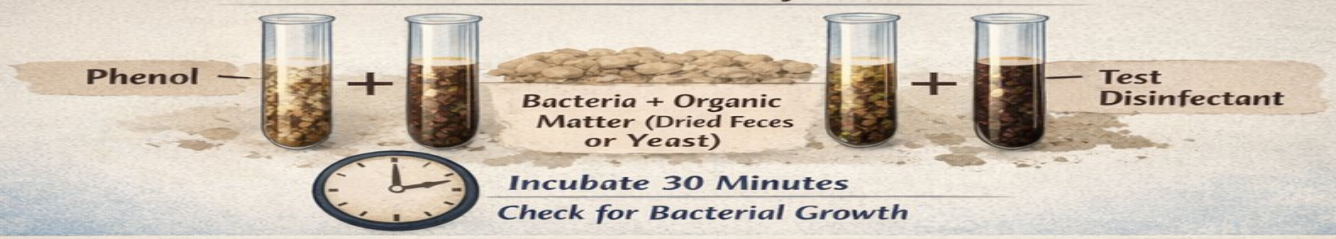
A. Phenol Coefficient Tests



The Chick-Martin Test (1908)

Developed by Harriette Chick & Charles James Martin

Phenol vs. Disinfectant in Dirty Conditions



Key Differences from Rideal-Walker Test

Rideal-Walker Test (1903)	Chick-Martin Test (1908)
- Clean Conditions	- Organic Matter Added
- Short Contact Time	- Fixed 30-Minute Time
- Salmonella typhi Only	- Salmonella typhi & Staphylococcus aureus
- High Phenol Coefficient	- Lower Phenol Coefficient

Procedure Overview

1. Mix Bacteria + Organic Matter
2. Add Serial Dilutions
3. Incubate 30 Minutes
4. Subculture to Broth

Calculating Phenol Coefficient

$$\text{Phenol Coefficient} = \frac{\text{Mean Phenol Concentration Allowing Survival}}{\text{Mean Disinfectant Concentration Allowing Survival}}$$

OR

$$\frac{\text{Effective Dilution of Disinfectant}}{\text{Effective Dilution of Phenol}}$$

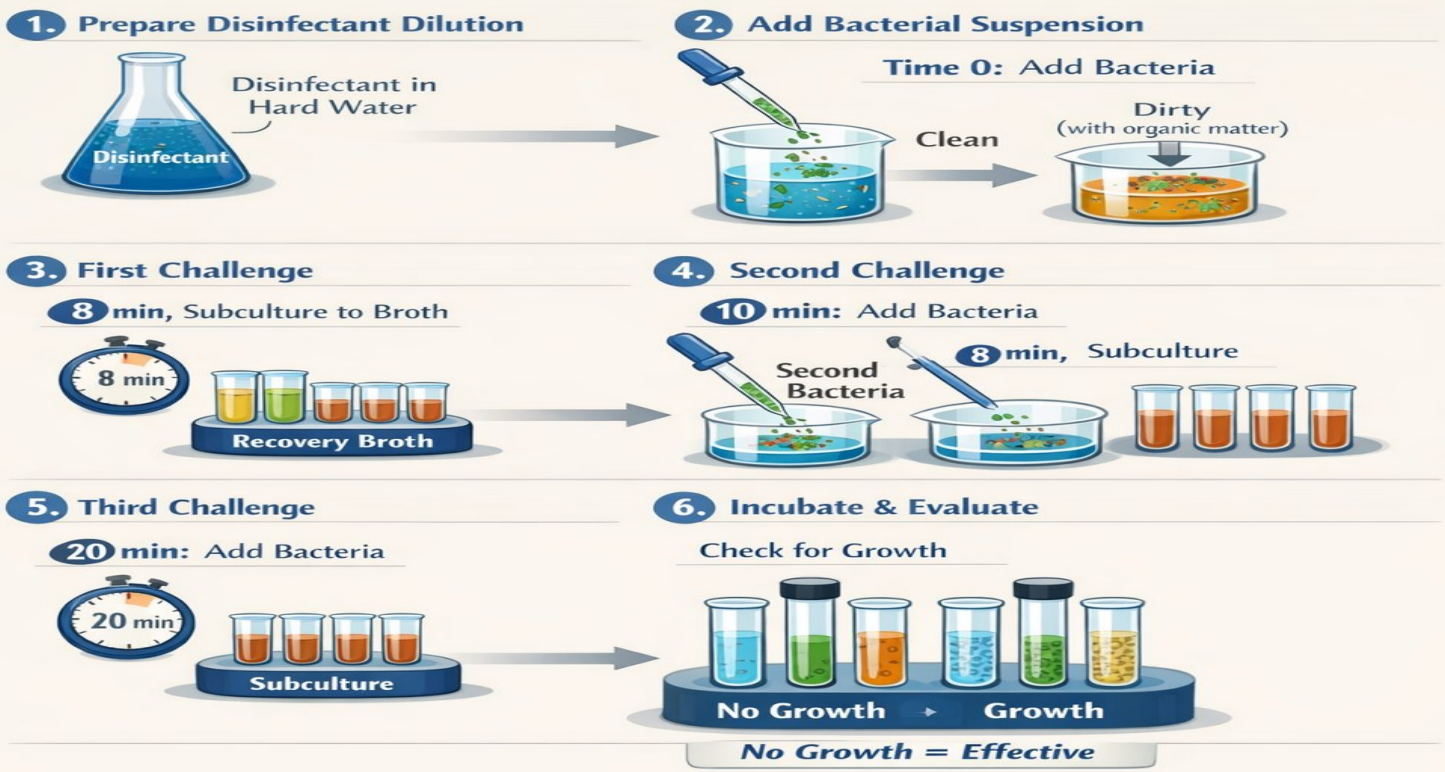
Results: >1 = More Effective than Phenol <1 = Less Effective than Phenol

Pioneering Test for Disinfectants in Realistic, Dirty Conditions


In-Use Test
Monitoring Disinfectant Contamination
1 mL Sample in Broth
Dilute & Neutralize
Incubate & Count Colonies
• 37°C | 3 Days
Room Temp
7 Days
Plate Drops on Agar
PASS
Less than 5 Colonies
FAIL
5 or More Colonies
Routine Hospital Testing
Ensure Disinfectant Safety

Kelsey-Sykes Capacity Test

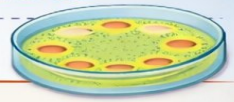
Testing Disinfectant Efficacy



Test Organisms: *S. aureus, E. coli, P. aeruginosa, P. vulgaris*

Agar Diffusion Method

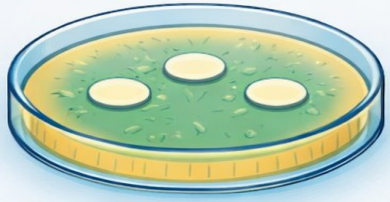
for Disinfectant Comparison



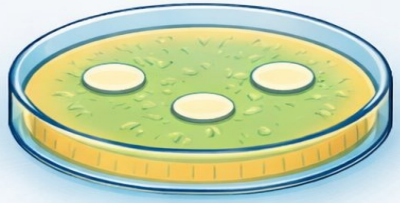
Procedure Steps

1. Inoculation
2. Disinfectant Application
3. Incubation
4. Observation

Zone of Inhibition Comparison



Larger Zone of Inhibition
More Effective Disinfectant



Smaller Zone of Inhibition
Less Effective Disinfectant

Key Considerations & Limitations

Diffusion Variability
Different chemicals diffuse at different rates

Solubility Issues
Poorly soluble agents may not diffuse

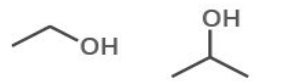
Bacteriostatic vs. Bactericidal
Inhibits growth vs. Kills bacteria

A BRIEF SUMMARY OF DISINFECTANTS & ANTISEPTICS

Key: USED FOR ANTISEPSIS | USED TO DISINFECT SURFACES | USED FOR STERILISATION (E.G. MEDICAL INSTRUMENTS) | USED FOR PRESERVATION

ALCOHOLS

USED IN ALCOHOL-BASED SANITARY HAND GELS PRESENT IN HOSPITALS

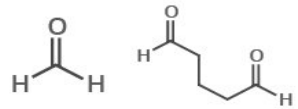


ETHANOL ISOPROPANOL

Kill many bacteria and fungi, and some viruses, when used at suitably high concentrations (usually 60-90% solution). Slow-acting, and evaporate easily, so lack residual action. Can't be used to sterilise.

ALDEHYDES

MAINLY USED FOR DISINFECTION & STERILISATION OF MEDICAL INSTRUMENTS

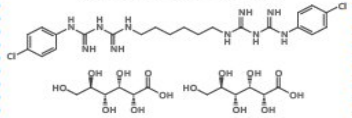


FORMALDEHYDE GLUTARALDEHYDE

Show broad activity against bacteria, fungi, and viruses. Not used for general antisepsis, due to their high toxicity. Due to the relatively long contact times required to disinfect, other agents are often preferred.

BIGUANIDES

USED IN CREAMS & FOR SKIN ANTISEPSIS IN SURGICAL PROCEDURES

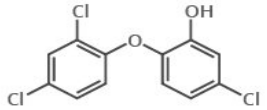


CHLORHEXIDINE DIGLUCONATE

Slow-acting, but don't evaporate easily like alcohols, so provide some residual activity. Active against most bacteria, and show some activity against fungi and viruses. Combination with alcohol increases efficacy.

BISPHENOLS

TRICLOSAN IS COMMONLY USED IN ANTISEPTIC SOAPS

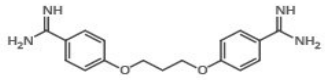


TRICLOSAN

Effective against bacteria, though more so against gram-positive bacteria. There are concerns surrounding triclosan's use in soaps due to its effects on the skin, and also due to its accumulation in the environment.

DIAMIDINES

MAINLY USED FOR THE TOPICAL TREATMENT OF WOUNDS



PROPAMIDINE

Less commonly used than the other featured compounds; halogenated derivatives of these compounds can also be used. Unlike some other agents, they still work in the presence of organic matter.

HALOGEN-RELEASING

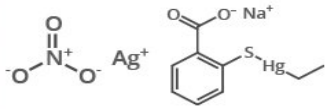
MAINLY USED FOR SURFACE DISINFECTION; FOUND IN HOUSEHOLD BLEACH

SODIUM HYPOCHLORITE IODINE

Affect bacteria, viruses, and fungi. Usually chlorine and iodine-containing compounds, with the halogens acting as oxidising agents on micro-organisms. Iodine solutions can cause irritation and staining.

METAL DERIVATIVES

RARELY USED FOR DISINFECTION, BUT CAN BE USED FOR VACCINE PRESERVATION

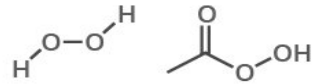


SILVER NITRATE THIOMERSAL

Silver salts are strongly bactericidal, and can be used to halt bacterial growth in burn wounds. Thiomersal is used as a preservative in some vaccines, and there are no causative links to any harmful effects.

PEROXYGENS

SUITABLE CONCENTRATIONS CAN BE USED FOR STERILISATION & ANTISEPSIS

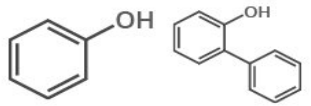


HYDROGEN PEROXIDE PERACETIC ACID

Widely used and environmentally friendly, as they decompose into safe by-products; most solutions need stabilisers to prevent decomposition. Broad spectrum of activity. Peracetic acid is the more potent.

PHENOLICS

USED FOR SURFACE DISINFECTION IN HOSPITALS AND LABORATORIES

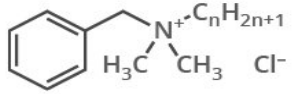


PHENOL *o*-PHENYLPHENOL

Phenol is no longer used as it is corrosive and carcinogenic. A number of derivatives are widely used, often for sterilising surfaces. They're partly responsible for the characteristic smell of hospitals.

QUATERNARY AMMONIUM SALTS

USED IN MANY ANTISEPTIC CREAMS AND KITCHEN SURFACE CLEANERS



BENZALKONIUM CHLORIDE

Low toxicity, so can be used to disinfect surfaces in food-handling areas. Work against gram positive bacteria and gram negative bacteria, though gram negative bacteria growth in solutions is possible.

Ideal Properties of Disinfectants / Antiseptics

Broad-Spectrum Activity

Kills Bacteria, Viruses & Fungi

Rapid Action

Works Quickly

Stable & Non-Toxic

Safe for Humans

Effective in Presence of Organic Matter

Works in Dirty Conditions

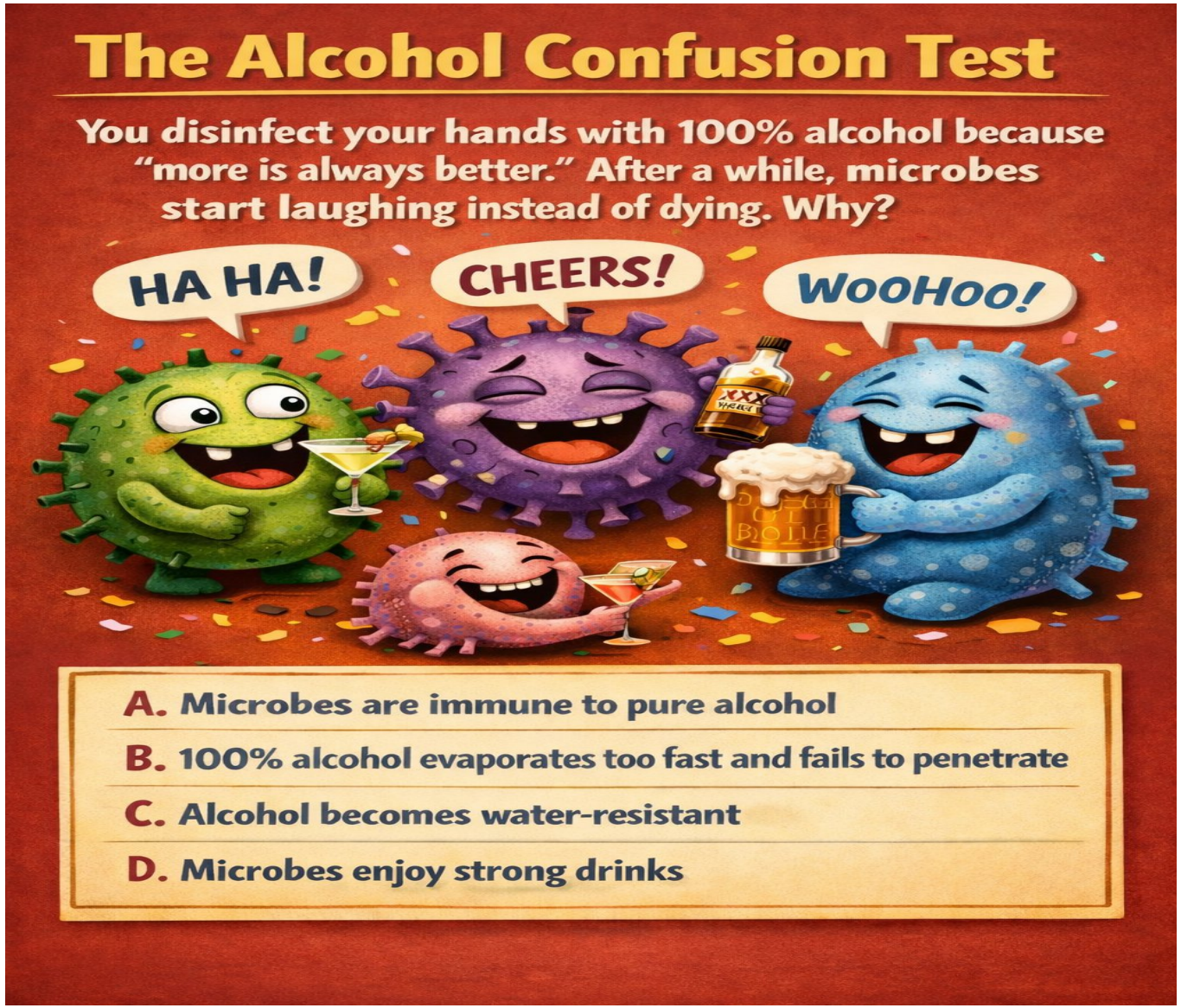
Non-Corrosive & Non-Staining

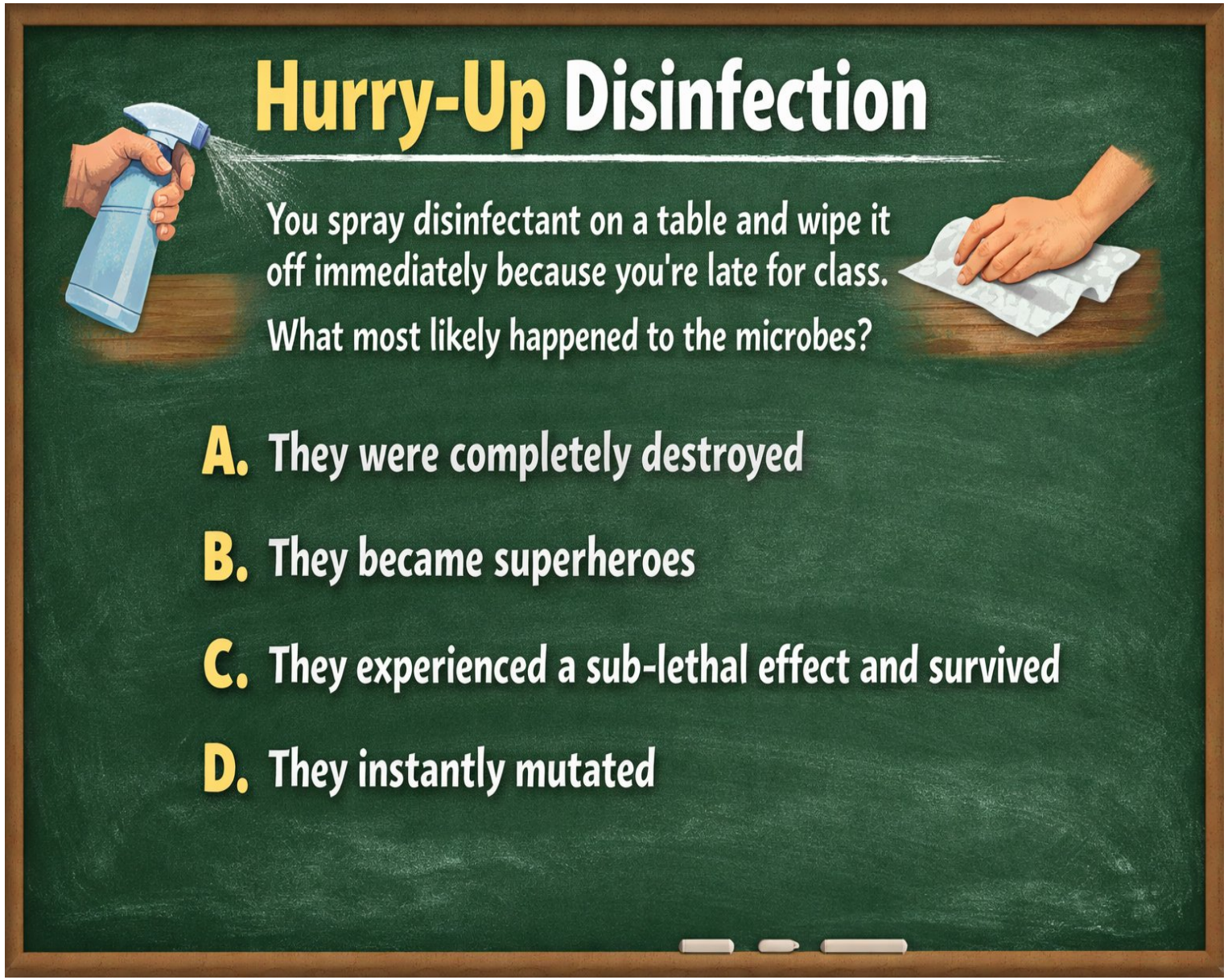
Gentle on Surfaces

Economical & Easy to Use

Affordable & Convenient

ASSESSMENT QUESTIONS




Hurry-Up Disinfection
You spray disinfectant on a table and wipe it off immediately because you're late for class.
What most likely happened to the microbes?
A. They were completely destroyed
B. They became superheroes
C. They experienced a sub-lethal effect and survived
D. They instantly mutated


MICROBIAL GYM SESSION
Low concentration disinfectant is used daily for a very short time.
Microbes exposed to this treatment will most likely:
A. Die instantly
B. Become weaker and disappear
C. Get "training sesions" and survive better next time
D. Start producing antibiotics
DISINFECTAN
STAY STRONG!
TRAINING IN PROGRESS
STAY STRONG!

The 5-Second Rule (Microbiology Edition)

A disinfectant needs 10 minutes contact time, but you give it only 1 minute.

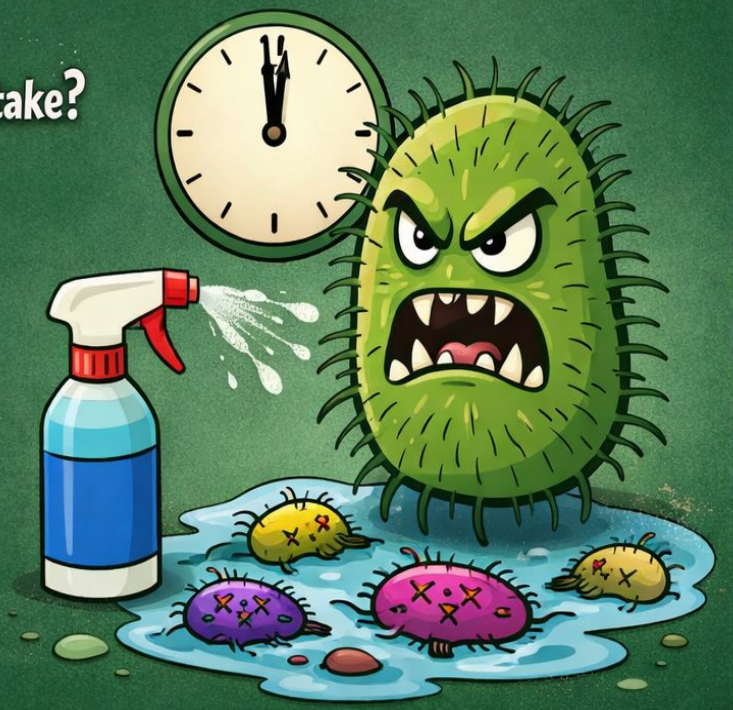
What is the scientific name for this mistake?

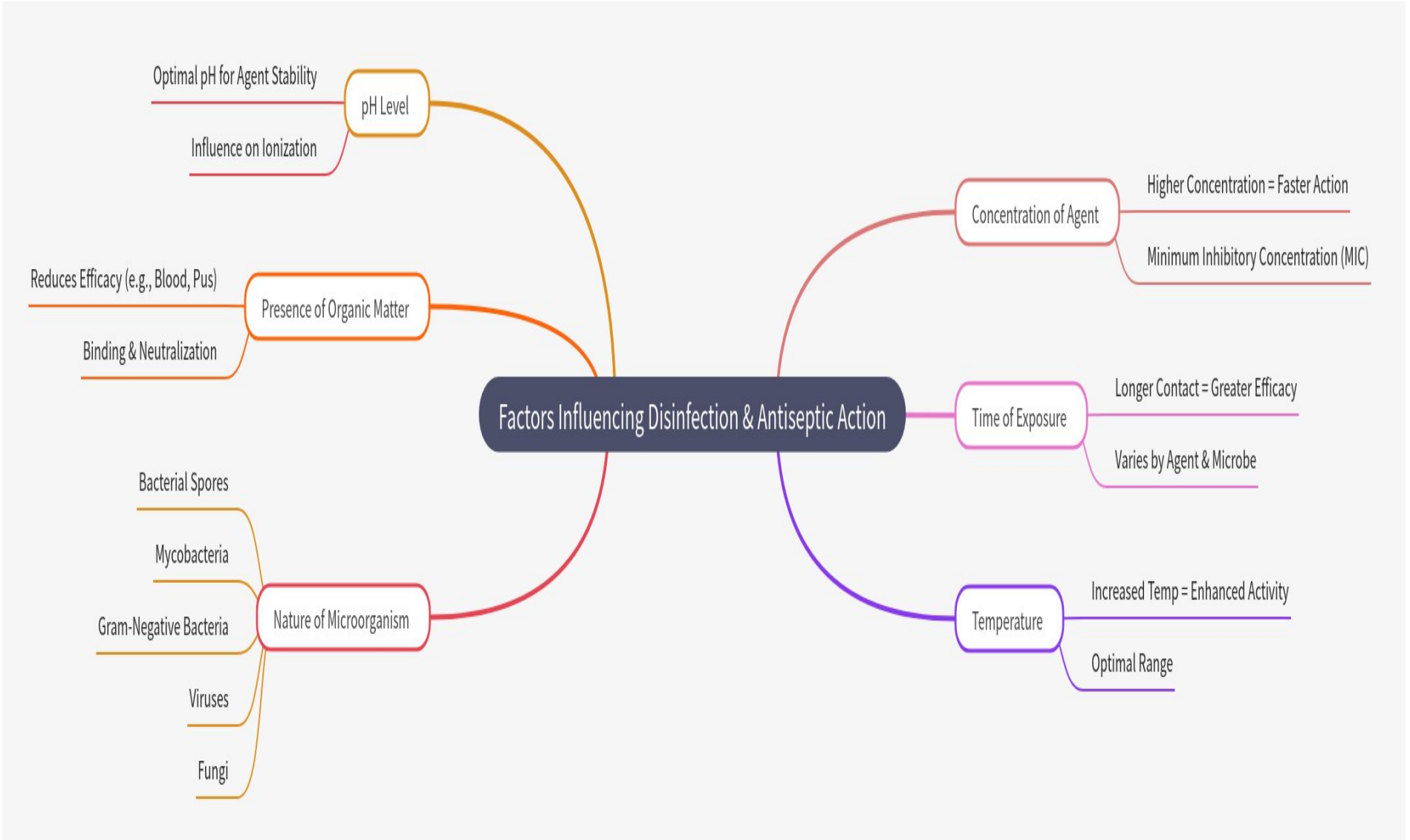
A. Time optimization

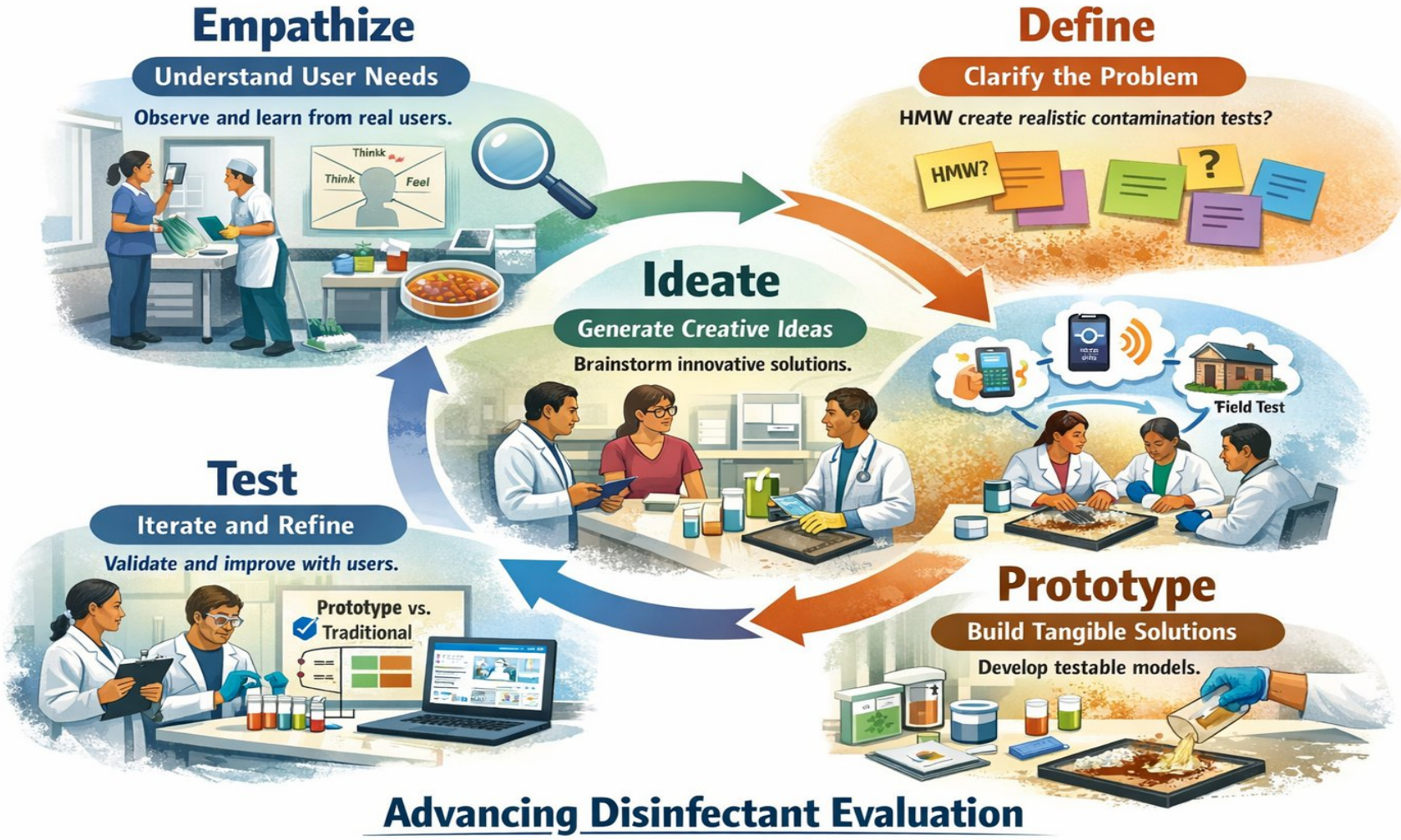
B. Incomplete sterilization

C. Sub-lethal exposure leading to survival

D. Speed disinfection technology




Factors Influencing Disinfection & Antiseptic Action
pH Level
Optimal pH for Agent Stability
Influence on Ionization
Presence of Organic Matter
Reduces Efficacy (e.g., Blood, Pus)
Binding & Neutralization
Nature of Microorganism
Bacterial Spores
Mycobacteria
Gram-Negative Bacteria
Viruses
Fungi
Concentration of Agent
Higher Concentration = Faster Action
Minimum Inhibitory Concentration (MIC)
Time of Exposure
Longer Contact = Greater Efficacy
Varies by Agent & Microbe
Temperature
Increased Temp = Enhanced Activity
Optimal Range


Empathize
Understand User Needs
Observe and learn from real users.
Think
Think
Feel
Define
Clarify the Problem
HMW create realistic contamination tests?
HMW?
?
Ideate
Generate Creative Ideas
Brainstorm innovative solutions.
Field Test
Test
Iterate and Refine
Validate and improve with users.
Prototype vs.
Traditional
Prototype
Build Tangible Solutions
Develop testable models.
Advancing Disinfectant Evaluation

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REFERENCES :

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2. Prescott and Dunn., Industrial Microbiology, 4th edition, CBS Publishers & Distributors, Delhi.

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THANK YOU