SI Microbiology - Full Discipline Demo

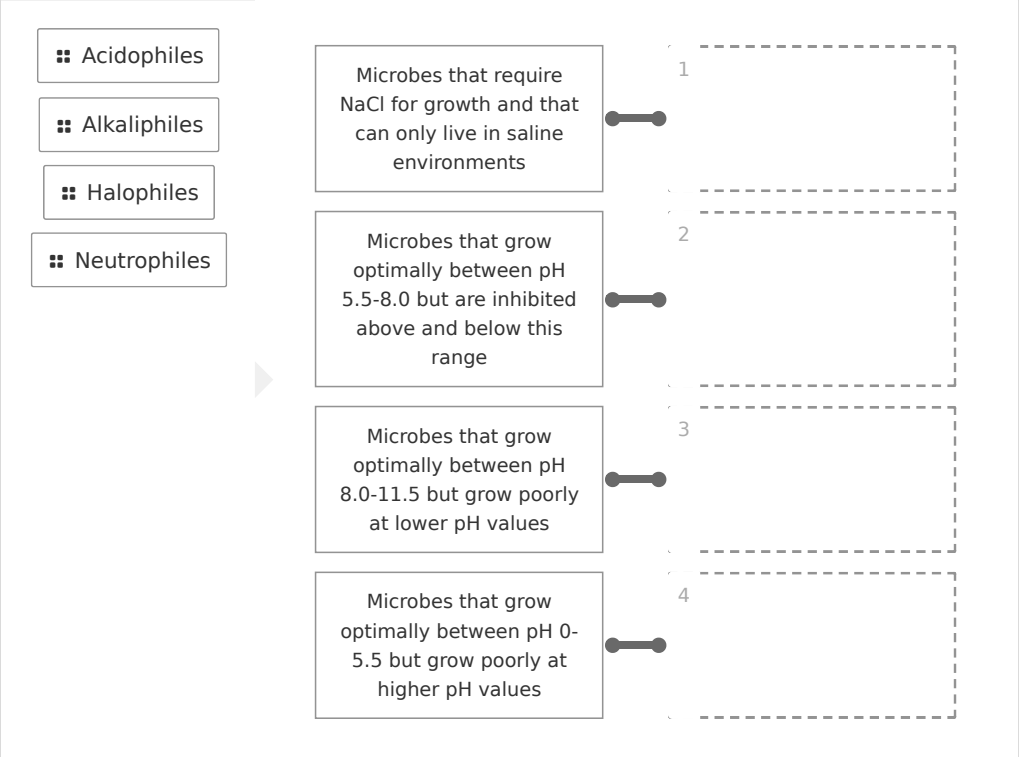
Salt Tolerance and pH Testing

Final Report - Answer Guide

Institution	Science Interactive University
Session	SI Microbiology - Full Discipline Demo
Course	SI Microbiology - Full Discipline Demo
Instructor	Sales SI Demo

Test Your Knowledge

Match each term with the best description.



Correct answers:

1 Halophiles 2 Neutrophiles 3 Alkaliphiles 4 Acidophiles

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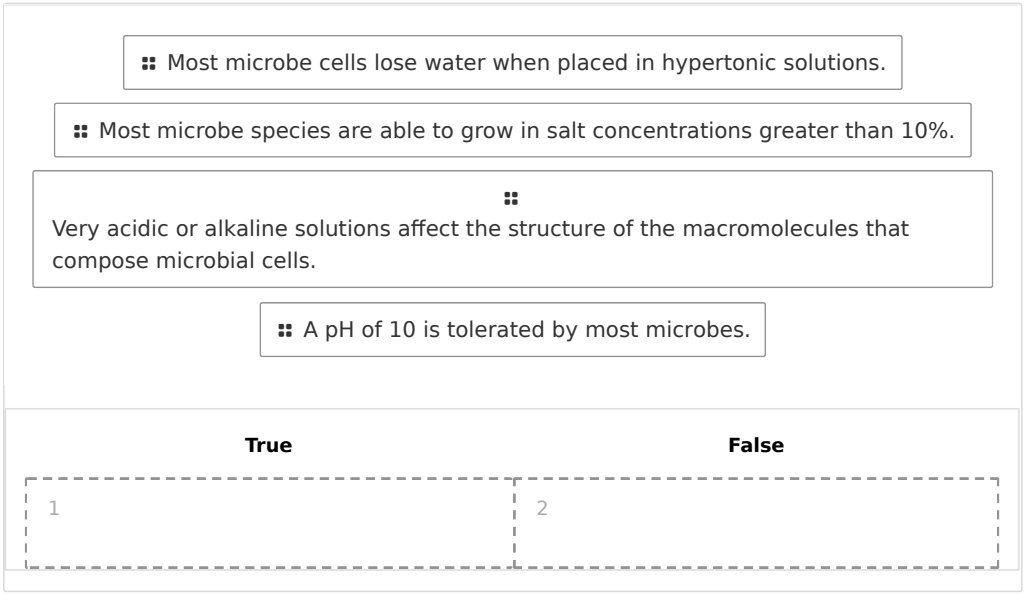
Identify each statement as true or false.



Correct answers:

1

Very acidic or alkaline solutions affect the structure of the macromolecules that compose microbial cells.

Most microbe cells lose water when placed in hypertonic solutions.

2

Most microbe species are able to grow in salt concentrations greater than 10%.

A pH of 10 is tolerated by most microbes.

Exploration

Most microbes maintain a salt concentration of _____ within the cytoplasm.

- 1% ✔
- 12%
- 27%
- 32%

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Both halotolerant microbes and halophiles require elevated concentrations of NaCl for growth.

- True
- False ✔

Proteins can be denatured by only moderate changes in pH.

- True ✔
- False

The majority of microbes are classified as _____.

- acidophiles
- alkaliphiles
- halophiles
- neutrophiles ✔

Exercise 1

Based on your results, what is the salt tolerance range for each microbe tested in this exercise? Reference Data Table 1 and Photo 1 in your explanation.

Based on the results of this experiment, the salt tolerance range for *S. cerevisiae* is 1% NaCl. The 1% NaCl broth was turbid after incubation, indicating growth, while the 7% and 15% NaCl broths remained clear as recorded in Data Table 1 and Photo 1. The salt tolerance range for *S. epidermidis*, based on results, is 1%-7% NaCl. Only the 15% NaCl broth remained clear after incubation, indicating no growth, as recorded in Data Table 1 and Photo 1.

Based on your experimental results, categorize each microbe as requiring isotonic environments, being halotolerant, or as a halophile.

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S. cerevisiae only grew in 1% NaCl and should be considered to prefer isotonic environments. *S. epidermidis* grew in both 1% and 7% NaCl suggesting it is a halotolerant microbe. Neither microbe is a halophilic since they both grew in isotonic 1% NaCl.

Data Table 1: Salt Tolerance Test Observations and Results
(SAMPLE ANSWER BELOW)

Tube	Observations	Conclusion
S.epidermidis 1% NaCl	Turbidity present in broth	Positive
S.epidermidis 7% NaCl	Turbidity present in broth	Positive
S.epidermidis 15% NaCl	Clear broth	Negative
S. cerevisiae 1% NaCl	Turbidity present in broth	Positive
S. cerevisiae 7% NaCl	Clear broth	Negative
S. cerevisiae 15% NaCl	Clear broth	Negative

Photo 1: NaCl Results
(SAMPLE ANSWER BELOW)

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Exercise 2

Based on our results, what is the pH range for each microbe tested in this exercise? Reference Data Table 2 and Photo 2 in your explanation.

Based on the results of this experiment, the pH range for *S. cerevisiae* is pH 5-7. Both the pH 5 and pH 7 broths were turbid after incubation, indicating growth, while the pH 9 broth remained clear as recorded in Data Table 2 and Photo 2. The pH range for *S. epidermidis*, based on results, is pH 7. Both the pH 5 and pH 9 broths remained clear after incubation, indicating no growth, as recorded in Data Table 2 and Photo 2.

Based on your pH testing results, categorize each microbe as an acidophile, neutrophile, or alkaliphile? Reference the definition of each term in your explanation.

Based on testing results, both microbes grew well at pH 7 and would be categorized as neutrophiles. *S. cerevisiae* also grew well at pH 5 but would not be categorized as an acidophile because acidophiles grow optimally between pH 0-5.5 but grow poorly at higher pH values. Neither microbe would be categorized as an alkaliphile as neither microbe grew at pH 9 and because alkaliphiles grow optimally between pH 8-11.5 but grow poorly at neutral pH values.

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***S. cerevisiae* occurs in nature on the surface of ripe fruit, a slightly acidic environment. *S. epidermidis* naturally occurs on human skin which can vary in salt concentrations based on sweating. How do your experimental results from Exercises 1 and 2 relate to the natural environment of each microbe?**

The pH of ripening fruit skin is slightly acidic and is supported by experimental results of *S. cerevisiae* growing well at pH 5 and pH 7. *S. epidermidis* is halotolerant which is supported by occurrence on the skin which may present variable saline conditions depending on how much an individual sweats.

Data Table 2: pH Testing Results
(SAMPLE ANSWER BELOW)

Tube	Observations	Conclusion
S.epidermidis pH 5	Clear	Negative
S.epidermidis pH 7	Turbid	Positive
S.epidermidis pH 9	Clear	Negative
S. cerevisiae pH 5	Turbid	Positive
S. cerevisiae pH 7	Turbid	Positive
S. cerevisiae pH 9	Clear	Negative

Photo 2: pH Testing Results
(SAMPLE ANSWER BELOW)

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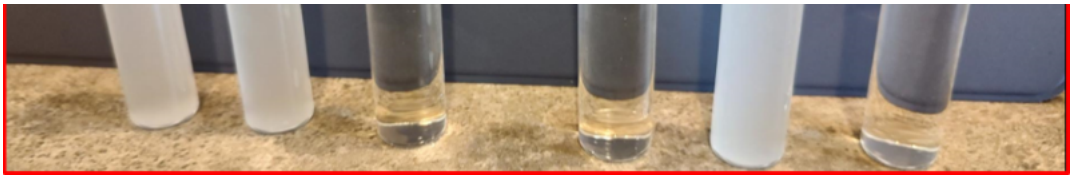

Competency Review

_____ grow optimally between pH 0-5.5 but grow poorly at higher pH values.

- Acidophiles ✔
- Alkaliphiles
- Neutrophiles
- Halophiles

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Most cyanobacteria and fungi found in coastal regions and associated floodplains are halotolerant microbes.

- [x] True ✔
- [ ] False

_____ solutions can lead to cell shrinkage and eventual death.

- [x] Hypertonic ✔
- [ ] Hypotonic
- [ ] Isotonic
- [ ] Neutral

High and low pH can affect _____ in microbe cells.

- [ ] hydrogen bonds
- [ ] macromolecule structure
- [ ] ATP production
- [x] All of the above ✔

Salt tolerance testing is performed by inoculating a series of saline broths with _____.

- [x] two drops of pure culture ✔
- [ ] an environmental swab sample
- [ ] a lyophilized pellet
- [ ] an ungloved fingertip

Turbidity is a indication of microbial growth in pH testing media.

- [x] True ✔
- [ ] False

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A microbe that produces clear broths when tested at 7% and 15% NaCl and turbid broth when tested at 1% NaCl is considered a halophile.

- True
- False ✔

A microbe that only produces turbid broths in pH tests at pH 7 is considered a(n) _____.

- acidophile
- alkaliphile
- neutrophile ✔
- halophile

Extension Questions

***Bacillus krulwichiae* sp. nov. is a halotolerant alkaliphile bacteria species that lives in soil. Apply your knowledge of salt tolerance and pH testing to predict the results this microbe would have produced in the experimental procedures of this lab.** (SAMPLE ANSWER BELOW)

Bacillus krulwichiae sp. nov. would be predicted to produce turbid 1%, 7%, and 15% NaCl broths and turbid pH 9 broths. Halotolerant microbes can tolerate up to 25% salt concentrations but will also grow well in 1% isotonic solutions. *Bacillus krulwichiae* sp. nov. would be expected to produce turbid pH 9 broth but clear pH 7 and pH 5 broths. Alkaliphiles grow at pH levels 8.0-11.5 but grow poorly at neutral pH values.

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