

Topic 4- pH

Multiple Choice

- Which series contains **only** basic pH values?
 A) pH 1.0, pH 3.5, pH 7.0 and pH 9.4 C) pH 7.1, pH 9.4, pH 10.9 and pH 14.0
 B) pH 5.0, pH 7.0, pH 7.5 and pH 10.0 D) pH 0.0, pH 9.0, pH 7.1 and pH 13.0
- The following table gives the colours of four different indicators in solutions with pH values ranging from 0 to 14.

pH														
Indicator 1	Red				Orange				Yellow					
Indicator 2	Blue				Green				Yellow					
Indicator 3	Red				Orange				Yellow					
Indicator 4	Colourless				Pink				Red					

All basic solutions can be identified by only one of the above indicators. Which indicator is this?

- A) Indicator 1 B) indicator 2 C) indicator 3 D) Indicator 4
- The following table gives the colours of the indicators phenolphthalein and methyl red in solutions that have pH values ranging from 1 to 14.

Phenolphthalein	Colourless							Pink		Red				
pH	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Methyl Red	Red				Orange			Yellow						

A mixture of these two indicators is added to a neutral solution. What colour will the mixture of the two indicators be in this neutral solution?

- A) Colourless B) yellow C) Orange D) Pink
- You wish to neutralize a solution with a pH of 3, using the least possible amount of another solution. Which of the following solutions would you use?
 A) A solution with a pH of 4 C) A solution with a pH of 8
 B) A solution with a pH of 6 D) A solution with a pH of 10
 - Following a chemical spill, the contaminated soil reaches a pH value of 10. After a few days, a neutralization process begins and a second test is conducted. Its results show that the pH of the soil has become 10 times more acidic. What is the pH value after the second test?
 A) pH= 1 B) pH= 7 C) pH= 9 D) pH= 11

6. In the laboratory, a student was given an unknown solution and asked to determine its approximate pH. He was also given two acid-base indicators, W and Z. The following table gives the colours of these two indicators after they are added to solutions with different pH values.

pH	2	3	4	5	6	7	8	9	10	11	12	
Indicator W	Yellow			Green			Blue					
Indicator Z	Red				Orange				Yellow			

The student added a drop of indicator W to a sample of the unknown solution. The solution turned blue. The student added a drop of indicator Z to another sample of the unknown solution. The solution turned orange. Which of the following could be the pH value of the unknown solution?

- A) 6 B) 7 C) 8 D) 9

7. The following table gives the colours of an acid-base indicator after it is added to solutions.

pH	2	3	4	5	6	7	8	9	10	11	12	
Indicator	Yellow			Orange			Red		Violet			

A few drops of this indicator are added to a highly acidic solution. What colour will the solution turn?

- A) It will turn yellow C) It will turn red
 B) It will turn orange D) It will turn violet

8. The following table gives the colours of an acid-base indicator after it is added to solutions with different pH values.

pH	2	3	4	5	6	7	8	9	10	11	12	
Colour	Orange				Yellow		Green		Blue			

What will be the colour of this indicator after it is added to a strongly basic solution?

- A) Blue B) Green C) Orange D) Yellow

9. Using pH paper, a student determined that rainwater has a pH of 5 and that seawater has a pH of 8. What can the student conclude from these results?

- A) Seawater is 3 times more acidic than rainwater.
 B) Seawater is 3 times more alkaline than rainwater.
 C) Seawater is 1000 times more acidic than rainwater.
 D) Seawater is 1000 times more alkaline than rainwater.

10. Maude is taking care of the family swimming pool over the summer. She carries out a test and sees that the pH of the water is 8.2. Since the pH value is too high, she must add one of the following products to the pool water: NaOH or HCl. Which product should she use and why?

- A) NaOH, because the pool water is acidic C) HCl, because the pool water is acidic
 B) NaOH, because the pool water is basic D) HCl, because the pool water is basic

11. The table below gives the result of pH tests conducted on four different solutions.

Solution	Indicator X	Indicator Y
1	Green	Yellow
2	Yellow	Yellow
3	Green	Orange
4	Blue	Red

The following table gives the colours of the two acid-base indicators after they are added to solutions with different pH values.

Indicator	pH											
	2	3	4	5	6	7	8	9	10	11	12	
X	yellow			green			blue					
Y	yellow				orange				red			

Which of the solutions is a very weak base?

- A) Solution 1 B) Solution 2 C) Solution 3 D) Solution 4

12. Scientists discovered that a certain bacterium grew best in a slightly alkaline environment. The table below gives the pH value of each environment in which this bacterium was cultivated.

pH Values in the Environments Tested

Environment	pH
1	2.4
2	6.1
3	7.6
4	13.2

In which of these environments did this bacterium grow best?

- A) Environment 1 B) Environment 2 C) Environment 3 D) Environment 4

13. The most widely sold dairy products on the market are pasteurized milk, cheese and yogourt. The pH of each of these products is given below.

Dairy product	pH
Cheese	7.5
Pasteurized milk	6.5
Yogourt	4.5

The most acidic of these products is how many times more acidic than the pasteurized milk?

- A) 2 times more acidic C) 20 times more acidic
 B) 10 times more acidic D) 100 times more acidic

14. The table below provides information on the pH values of three solutions.

Solution X	Solution Y	Solution Z
pH 7	100 times more acidic than solution X	10 times more basic than solution Y

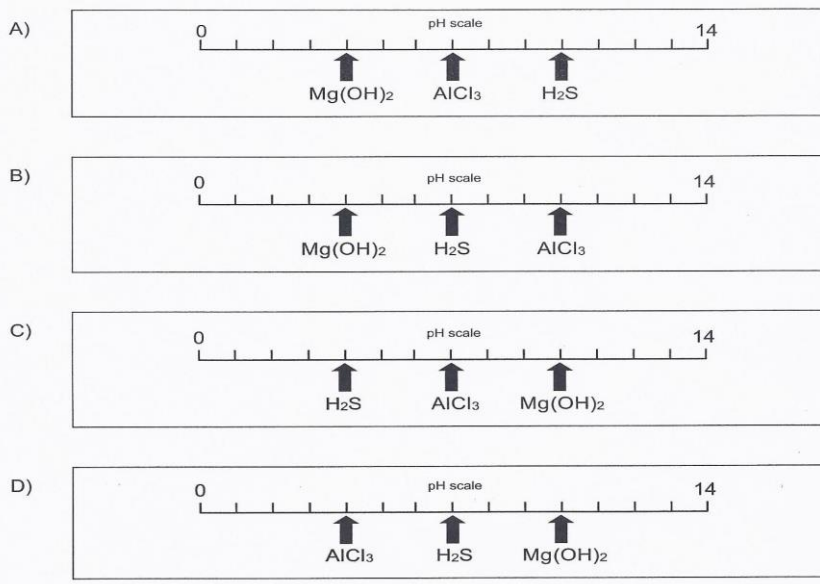
Which of the following choices presents the solutions, in order, from the lowest to the highest pH?

- A) X – Z – Y B) Y- X – Z C) Y – Z – X D) Z – X – Y

15. Listed below are the molecular formulas of three substances in an aqueous solution.



Which of the following choices shows all three substances correctly positioned on the pH scale?



16. Table 1 below gives the colours of two acid base indicators after they are added to solutions with different pH values.

Table I - COLOURS OF INDICATOR X AND INDICATOR Y AT DIFFERENT PH VALUES

Indicator \ pH	2	3	4	5	6	7	8	9	10	11	12
X	yellow			green		blue					
Y	blue	violet		red							

Table II below gives the colours of the two indicators after they were added to four solutions with different pH values.

Table II - COLOURS OF INDICATOR X AND INDICATOR Y

Solution	Indicator X	Indicator Y
1	yellow	blue
2	yellow	violet
3	green	red
4	blue	red

Which of these 4 solutions can be used to neutralize a solution with a pH of 3.5?

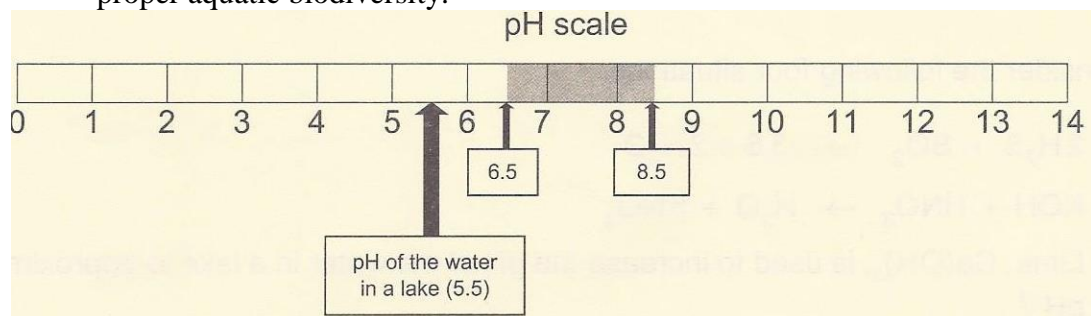
A) Solution 1

B) Solution 2

C) Solution 3

D) Solution 4

17. The pH of lakes must be between a minimum of 6.5 and a maximum of 8.5 to maintain proper aquatic biodiversity.



Which of the statements below completes the following sentence correctly? If the pH of the water in a lake is 5.5, this pH ...

- A) Is 1 time more acidic than the minimum acceptable pH.
- B) Is 3 time more acidic than the minimum acceptable pH.
- C) Is 30 times more acidic than the maximum acceptable pH.
- D) Is 1000 times more acidic than the maximum acceptable pH.

18. Corn grows best in soils with a pH of 6. When the soil pH is too low, the corn's growth is stunted. Alicia noticed that her corn crop is not growing well. She tests the pH of the soil and discovers that it has a pH of 4. Which of the following statements describes the change that must occur so that the corn has ideal growing conditions?

- A) Alicia must make the corn 100 times more acidic.
- B) Alicia must make the corn 100 times less acidic.
- C) Alicia must make the corn 2 times more acidic.
- D) Alicia must make the corn 10 times less acidic.

19. Joanne carried out experiments to determine the pH value of different substances. The following table shows the results.

Substances	Lemon juice	Coffee	Seawater	Soap	Liquid bleach
pH value	2	5	8	9	12

Which of the following statements is true?

- A) Liquid bleach is 6 times less acidic than lemon juice.
- B) Lemon juice is 4 times more acidic than seawater.
- C) Liquid bleach is 7 times less basic than coffee.
- D) Soap is 10 times more basic than seawater.

20. The soil in a backyard garden has a pH of 6. A gardener would like to grow potato plants in his garden and wants the soil to have a pH of 8. What should the gardener do?

- A) Add an acid to make the soil two times more acidic.
- B) Add an acid to make the soil one hundred times more acidic.
- C) Add a base to make the soil two times more basic
- D) Add a base to make the soil one hundred times more basic.

21. Which of the following correctly indicates each compound and its characteristic on the pH scale?

A)

B)

C)

D)

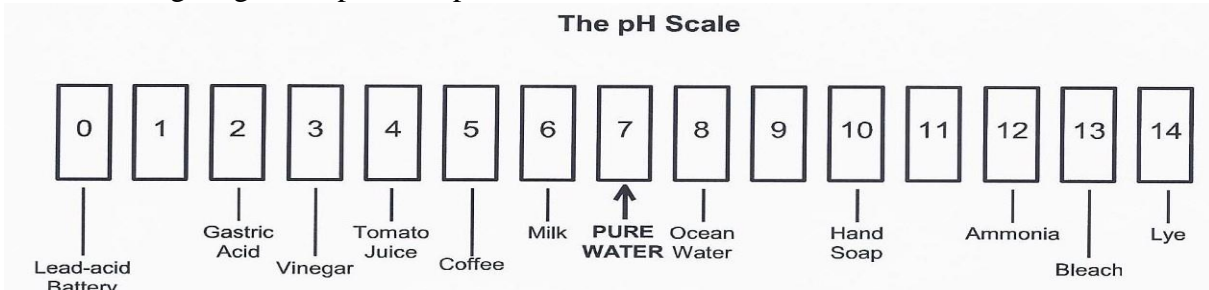
22. The following table lists different substances and their pH value.

Substance	pH
Soft drinks	3
Tomato juice	4
Milk	6
Seawater	8
Soap	10
Sodium hydroxide	14

Which of the following statements is true?

- A) Milk is slightly basic
- B) Soap is more basic than seawater
- C) Sodium hydroxide is the most acidic
- D) Soft drinks are less acidic than tomato juice

23. The following diagram depicts the pH of common substances.



How many times more acidic is milk than ocean water?

- A) 100 times
- B) 10 times
- C) 2 times
- D) 0.01 times

Short Answer

24. An abnormal pH level was observed in the waters of a region in Canada. In some rivers and streams, the pH even reached a value of 4.

a) Which one of the available substances should be added to the water of these rivers and streams to restore their normal pH? State the nature of the substance chosen.

Available substances
Ca(OH) ₂
CH ₃ COOH
K ₂ O

b) What change should occur in the pH of these rivers and streams so that their normal pH value is restored?

25. One of the ways to neutralize soil is to cover it with lime, Ca(OH)₂. The following table lists the pH value of three different soils.

Soil	pH
A	8
B	7
C	6

Which soil, A, B or C, needs to be covered with lime in order to neutralize it? Justify.

26. In the laboratory, you are given two acidic solutions. One has a pH value of 5, and the other has a pH value of 6.8. You are also given the following four indicators.

1) Methyl orange

pH	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Red			Orange		Yellow								

2) Bromothymol blue

pH	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Yellow					Green		Blue						

3) Phenolphthalein

pH	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Colourless								Pink		Dark pink			

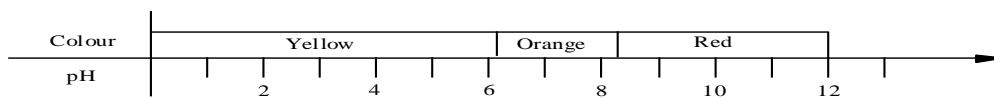
4) m-Cresol purple

pH	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Yellow							Brown		Violet				

Name the only indicator that would allow you to distinguish between the two solutions.

27. Nathalie is a technician in a company that grows lettuce hydroponically. For the lettuce to grow, the acidity must be kept between pH 5.6 and 6.4. All of a sudden, the monitoring equipment indicates that the pH has dropped to 5.0. What must Nathalie do to re-establish the correct pH? Explain.

28. The table below indicates the colour of the indicator phenol red in solutions with a pH varying from 1 to 12.



A drop of this indicator is added to some lemon juice. What colour is the indicator after being added to the lemon juice?

29. The following table shows the colour of a universal indicator in solutions varying pH values.

pH	Colour
0	red
1	red
2	red
3	red-orange
4	red-orange
5	orange
6	yellow
7	yellow-green
8	green
9	green-blue
10	blue
11	blue
12	blue
13	blue

What colour would the indicator be in a very alkaline (basic) detergent?