

## Topic 3- Electrolytes

Multiple Choice:

1. You have a sample of sodium hydroxide (NaOH), which is a white solid. You want to show in the laboratory that this sample is a base. Under which condition will this sample manifest its basic properties?
  - A) On condition that it is dissolved in water
  - B) On condition that there is sufficient quantity of it
  - C) On condition that it is sufficiently compressed
  - D) On condition that it is in powder form

Answer: A

2. The following four tests are to be carried out to determine if an aqueous solution is acidic.
  1. Dip a piece of cobalt dichloride paper into the solution.
  2. Dip a piece of red and a piece of blue litmus paper into the solution.
  3. Check the electrical conductivity of the solution.
  4. Dip a piece of magnesium ribbon into the solution.Which two of these tests will definitely confirm that the solution is acidic?
  - A) 1 and 2
  - B) 2 and 3
  - C) 2 and 4
  - D) 3 and 4

Answer: B

3. The following four compounds are to be mixed (separately) with water:  
 $C_6H_{12}O_6$        $MgSO_4$        $C_2H_5OH$        $KOH$   
Which two of these compounds will produce an electrolytic solution when mixed with water?
  - A)  $C_6H_{12}O_6$  and  $MgSO_4$
  - B)  $C_6H_{12}O_6$  and  $C_2H_5OH$
  - C)  $MgSO_4$  and  $KOH$
  - D)  $C_2H_5OH$  and  $KOH$

Answer: C

4. One of the properties of bases is that they dissolve fats. Which of the following substances could be used to clear the grease that accumulates in the drain of a sink?
  - A)  $Na_2SO_4$
  - B)  $MnO_2$
  - C)  $H_3PO_4$
  - D)  $LiOH$

Answer: D

5. Four chemical substances are given below.
  1.  $H_2SO_4$
  2.  $Ca(OH)_2$
  3.  $MgCl_2$
  4.  $C_2H_5OH$Which of these substances is a base?
  - A) Substance 1
  - B) Substance 2
  - C) Substance 3
  - D) Substance 4

Answer: B

6. Associate each substance with the correct characteristic.

<u>Substances</u>	<u>Characteristics</u>
1. Aqueous aluminium hydroxide, $\text{Al}(\text{OH})_{3(\text{aq})}$	a) acid
2. Aqueous calcium hydroxide, $\text{Ca}(\text{OH})_{2(\text{aq})}$	b) neutral
3. Aqueous acetic acid, $\text{HCH}_3\text{CO}_{2(\text{aq})}$	c) basic
4. Aqueous lithium hydroxide, $\text{LiOH}_{(\text{aq})}$	
5. Aqueous hydrogen chlorate, $\text{HClO}_{3(\text{aq})}$	
A) 1a, 2a, 3c, 4a and 5c	C) 1c, 2a, 3b, 4c and 5a
B) 1c, 2c, 3a, 4c and 5a	D) 1a, 2c, 3b, 4c and 5a

Answer: A

7. Three colourless solutions were labelled as shown in the table below.

Solution	Label
X	$\text{MgCl}_2$
Y	$\text{HNO}_3$
Z	$\text{Ca}(\text{OH})_2$

Which of the following tables correctly indicates the nature of these three solutions?

A)	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Solution</th> <th>Nature</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>Acid</td> </tr> <tr> <td>Y</td> <td>Base</td> </tr> <tr> <td>Z</td> <td>Salt</td> </tr> </tbody> </table>	Solution	Nature	X	Acid	Y	Base	Z	Salt	C)	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Solution</th> <th>Nature</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>Base</td> </tr> <tr> <td>Y</td> <td>Acid</td> </tr> <tr> <td>Z</td> <td>Salt</td> </tr> </tbody> </table>	Solution	Nature	X	Base	Y	Acid	Z	Salt
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Answer: B

8. To check the electrical conductivity of certain substances, a student used a conductivity apparatus equipped with a light bulb. Her observations are listed in the following table.

Substances	Observations
HCl	Bright light
$\text{CH}_3\text{OH}$	No light
$\text{MgCl}_2$	Faint light
NaOH	Bright light
$\text{CH}_3\text{COOH}$	Faint light
$\text{CCl}_4$	No light

Which one of the following groups of substances contains only electrolytes?

- |  |   |
|--|---|
| A) $\text{CH}_3\text{OH}$ and $\text{CCl}_4$ | C) $\text{CH}_3\text{OH}$ , NaOH and $\text{CH}_3\text{COOH}$ |
| B) HCl, $\text{MgCl}_2$ and $\text{CCl}_4$   | D) HCl, $\text{MgCl}_2$ , NaOH and $\text{CH}_3\text{COOH}$   |

Answer: D

9. Which statement correctly defines an electrolyte?
- A) A substance that conducts an electric current
  - B) A substance that does not conduct an electric current
  - C) A substance that conducts an electric current when dissolved in an aqueous solution
  - D) A substance that does not dissolve in water

Answer: C

10. Which of the following is **not** a salt?
- A)  $\text{NaNO}_3$
  - B)  $\text{MgBr}_2$
  - C)  $\text{H}_2\text{O}$
  - D)  $\text{Al}_2\text{S}_3$

Answer: C

11. Scientific studies show that the number of aquatic species declines when a lake becomes more acidic. The pH of the water in four lakes was measured to determine whether aquatic species are threatened. The table below lists the pH values obtained.

Table I - pH of the lakes examined

Lake	pH	Lake	pH
1	4.2	3	7.0
2	6.5	4	7.8

Which of these lakes poses the greatest threat to aquatic species?

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

Answer: A

12. Which of the following are **bases**?
- 1.  $\text{NaOH}$
  - 2.  $\text{HCl}$
  - 3.  $\text{LiF}$
  - 4.  $\text{NH}_4\text{OH}$
  - 5.  $\text{BeO}$
  - 6.  $\text{HI}$
  - 7.  $\text{KOH}$
  - 8.  $\text{CaCl}_2$
- A) 1, 4 and 7
  - B) 2, 3 and 8
  - C) 3, 5 and 6
  - D) 1, 3 and 7

Answer: A

13. Which of the following are **acids**?
- 1.  $\text{NaOH}$
  - 2.  $\text{HCl}$
  - 3.  $\text{LiF}$
  - 4.  $\text{NH}_4\text{OH}$
  - 5.  $\text{BeO}$
  - 6.  $\text{HI}$
  - 7.  $\text{KOH}$
  - 8.  $\text{CaCl}_2$
- A) 1, 5 and 8
  - B) 2 and 6
  - C) 5, 6 and 8
  - D) 3, 4 and 7

Answer: B

14. Five chemical compounds are listed below:
- 1-  $\text{NF}_3$
  - 2-  $\text{CaCl}_2$
  - 3-  $\text{NaOH}$
  - 4-  $\text{PCl}_3$
  - 5-  $\text{HBr}$
- When dissolved in water, which of these compounds conduct electricity?
- A) 1, 2 and 3
  - B) 1, 4 and 5
  - C) 2, 3 and 5
  - D) 3, 4 and 5

Answer: C

15. The incomplete table gives information on three aqueous solutions.

Information on Different Aqueous Solutions

Solution	Chemical formula of solute	pH	Electrical conductivity
1		2	
2			weak
3	$C_6H_{12}O_6$		

Which of the following statements is true?

- A) Only solution 1 conducts an electric current.
- B) Solutions 1 and 2 conduct an electric current.
- C) Solutions 2 and 3 conduct an electric current.
- D) Solutions 1, 2 and 3 conduct an electric current

Answers: B

16. Four different solutions made with distilled water are described below.

Solution	Characteristic
1	Aqueous solution with a pH of 11
2	Vinegar solution ( $HCH_3COO$ )
3	Glucose solution ( $C_6H_{12}O_6$ )
4	Ionic solution with a pH of 7

Which of these solutions can conduct an electric current?

- A) Solutions 1, 2 and 3
- B) Solutions 1, 2 and 4
- C) Solutions 1, 3 and 4
- D) Solutions 2, 3 and 4

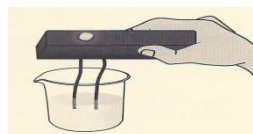
Answers: B

17. A student is testing the conductivity of a solution. She observes that the solution conducts electricity. Which of the following combinations includes ONLY substances that will cause the solution to conduct electricity?

- A) HF, LiOH, KBr
- B)  $C_2H_6$ ,  $CCl_4$ ,  $C_6H_{12}O_6$
- C)  $BeF_2$ ,  $CCl_4$ ,  $C_2H_5OH$
- D) LiOH, NaCl,  $C_6H_{12}O_6$

Answer: A

18. An unknown solid substance is dissolved to distilled water to form a solution. Two electrodes are connected to a light bulb and immersed in solution, as illustrated below. The light bulb goes on.

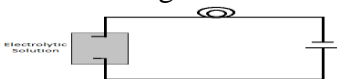


Why does the light bulb go on? Because the solution contains ...

- A) ...mobile ions
- B) ...mobile atoms
- C) ... mobile electrons
- D) ...mobile molecules

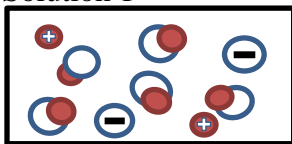
Answer: A

19. A student is designing a circuit with a light and an electrolytic solution as seen below.

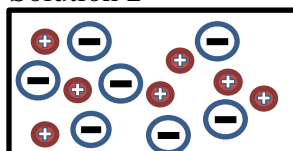


The student notices that the brightness of the light varies according to which of the three solutions below is used to complete the circuit.

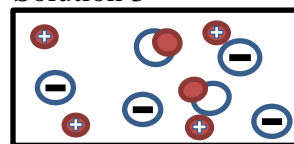
Solution 1



Solution 2



Solution 3



Which of the following ranks the brightness of the light, from dimmest to the brightest, when using the electrolytic solutions?

A) 1, 2, 3

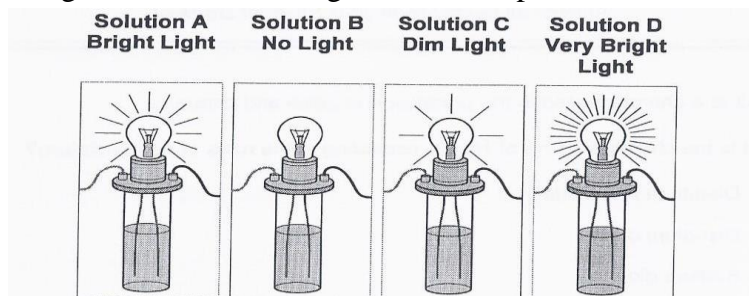
B) 1, 3, 2

C) 2, 3, 1

D) 2, 1, 3

Answer: B

20. Ann is given the task of testing four unknown solutions. All four solutions are tested using two electrodes, a light bulb and a power source. The results are shown below.



Which of the following choices ranks the solutions in DECREASING (highest to lowest) order of electrolyte dissociation?

A) B – C – D – A

B) B – C – A – D

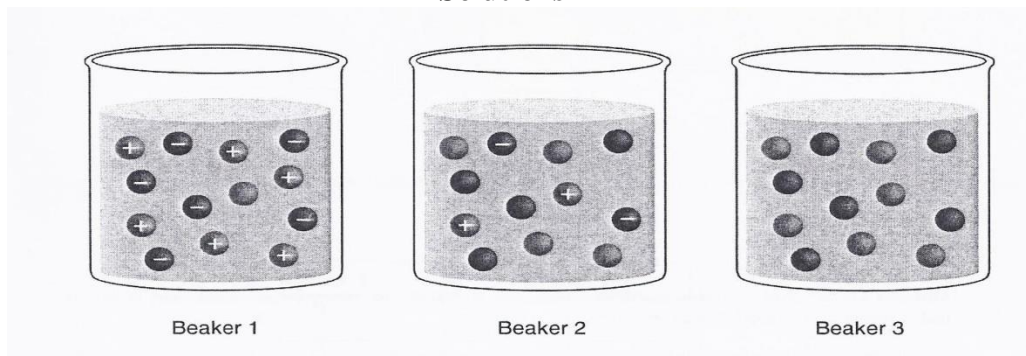
C) D – A – C – B

D) D – C – A – B

Answer: C

21. Solutions can be categorized as non-electrolytes, weak electrolytes and strong electrolytes. Glucose  $C_6H_{12}O_6$ , is a non-electrolyte when dissolved in water. Citric acid,  $C_6H_8O_7$ , the acid in orange juice, is a weak electrolyte when dissolved in water. Hydrochloric acid  $HCl$ , sometimes known as stomach acid, is a strong electrolyte. A drawing of the particles in three different solutions is shown below.

**Solutions**

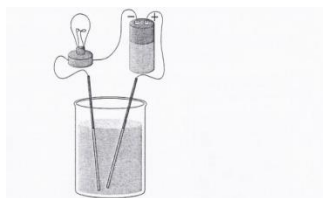


Which of the following is correct?

	Beaker 1	Beaker 2	Beaker 3
A)	Glucose	Hydrochloric acid	Citric acid
B)	Hydrochloric acid	Citric acid	Glucose
C)	Citric acid	Hydrochloric acid	Glucose
D)	Glucose	Citric acid	Hydrochloric acid

Answer: B

22. Melissa works in a laboratory. In order to investigate the type of chemical bonding in the three unknown solids, Melissa dissolves them in water and tests their electrical conductivity using the apparatus below.

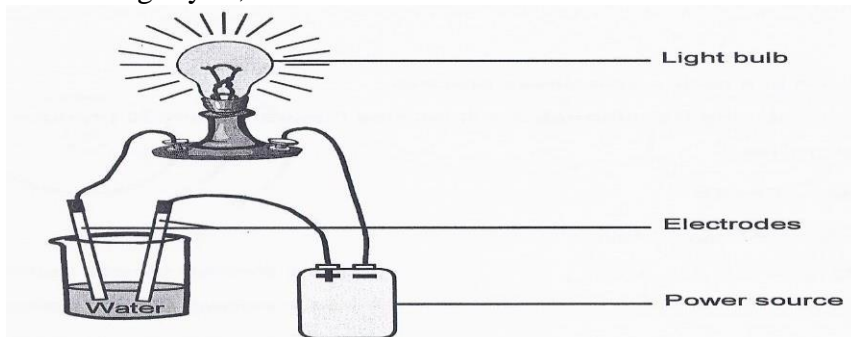


Melissa knows that ionically bonded solids will conduct electricity when dissolved in water, but covalently bonded solids will not. Which of the following samples, in their aqueous solutions, would ALL make the light bulb glow?

- A)  $MgCO_3$ ,  $I_2$  and  $SiO_2$
- B)  $Fe_2O_3$ ,  $N_2O_5$  and  $NaCl$
- C)  $NH_4OH$ ,  $CaCl_2$  and  $K_2O$
- D)  $KBr$ ,  $Ca(OH)_2$  and  $C_6H_{12}O_6$

Answer: C

23. An unknown substance is dissolved in water. The aqueous solution is then tested in an experiment using a light bulb, two electrodes and a power source. The light bulb is brightly lit, as illustrated below.

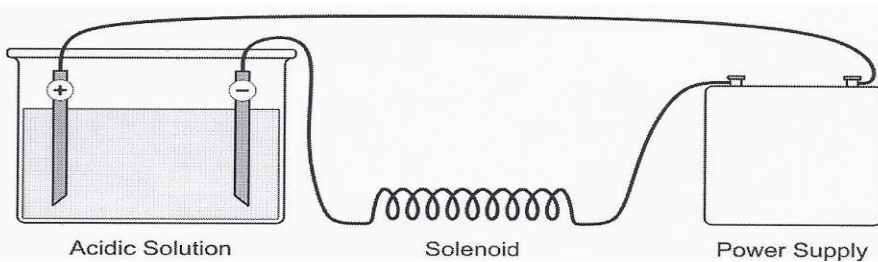


Which of the following statements best describes the scientific phenomenon?

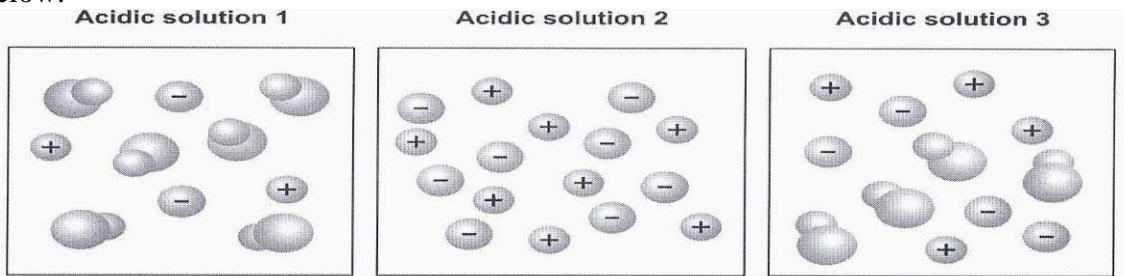
- A) The unknown substance does not produce ions in water
- B) The unknown substance produces very few ions in water
- C) The unknown substance undergoes high electrolytic dissociation
- D) The unknown substance does not undergo electrolytic dissociation

Answer: C

24. An engineering student is designing a circuit. The design is such that the circuit uses an acidic solution as shown below.



She wants to vary the intensity by using three different acidic solutions which are illustrated below.



Which of the following correctly ranks the acidic solution with dissociation from strongest to weakest?

- A) 1, 3 and 2
- B) 2, 1 and 3
- C) 3, 2 and 1
- D) 2, 3 and 1

Answer: D

## Short Answer

25. The table shows the molecular formulas of different compounds. They are classified into three groups: acids, bases and salts. Determine the probable nature (acid, base or salt) of each group. Complete the table, indicating your choice.

<b>GROUP</b>	<b>MOLECULAR FORMULAS</b>	<b>PROBABLE NATURE OF THE GROUP</b>
1	NaOH Ca(OH) <sub>2</sub>	?
2	HCH <sub>3</sub> CO <sub>2</sub> HNO <sub>3</sub>	?
3	NaCl NaNO <sub>3</sub>	?

Answer: 1= base      2= acid      3- salt

26. Josie needs to neutralize a window-cleaner that contains ammonia. When she tests it with red litmus paper, the paper turns blue. What type of substance must she use to neutralize it?

Answer: Acid because the window cleaner is a base