

## Electrolyte

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| <p>1 A 0.050 M aqueous solution of which compound is the best conductor of electric current?</p> <p>(1) <math>C_3H_7OH</math>                      (3) <math>MgSO_4</math><br/> (2) <math>C_6H_{12}O_6</math>                      (4) <math>K_2SO_4</math></p> <p>2 Which statement describes an electrolyte?</p> <p>(1) An electrolyte conducts an electric current as a solid and dissolves in water.<br/> (2) An electrolyte conducts an electric current as a solid and does not dissolve in water.<br/> (3) When an electrolyte dissolves in water, the resulting solution conducts an electric current.<br/> (4) When an electrolyte dissolves in water, the resulting solution does not conduct an electric current.</p> <p>3 Which solution is the best conductor of an electric current?</p> <p>(1) 0.001 mole of NaCl dissolved in 1000. mL of water<br/> (2) 0.005 mole of NaCl dissolved in 1000. mL of water<br/> (3) 0.1 mole of NaCl dissolved in 1000. mL of water<br/> (4) 0.05 mole of NaCl dissolved in 1000. mL of water</p> | <p>4 Why is potassium nitrate classified as an electrolyte?</p> <p>(1) It is a molecular compound.<br/> (2) It contains a metal.<br/> (3) It can conduct electricity as a solid.<br/> (4) It releases ions in an aqueous solution.</p> <p>5 Which substance is an electrolyte?</p> <p>(1) <math>CCl_4</math>                              (3) <math>SiO_2</math><br/> (2) <math>C_6H_{12}O_6</math>                      (4) <math>H_2SO_4</math></p> <p>6 The electrical conductivity of an aqueous solution depends on the concentration of which particles in the solution?</p> <p>(1) molecules                      (3) atoms<br/> (2) electrons                      (4) ions</p> <p>7 Which compound is an electrolyte?</p> <p>(1) <math>H_2O</math>                              (3) <math>H_3PO_4</math><br/> (2) <math>C_2H_6</math>                              (4) <math>CH_3OH</math></p> <p>8 Which substance is an electrolyte?</p> <p>(1) <math>O_2</math>                              (3) <math>C_3H_8</math><br/> (2) <math>Xe</math>                              (4) <math>KNO_3</math></p> <p>9 Which compounds are classified as electrolytes?</p> <p>(1) <math>KNO_3</math> and <math>H_2SO_4</math><br/> (2) <math>KNO_3</math> and <math>CH_3OH</math><br/> (3) <math>CH_3OCH_3</math> and <math>H_2SO_4</math><br/> (4) <math>CH_3OCH_3</math> and <math>CH_3OH</math></p> |
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Base your answers to questions 10 on the information below and on your knowledge of chemistry.

The electrical conductivity of three aqueous solutions was tested at room temperature. A 0.1 M HCl(aq) solution conducted, but a 6.0 M HCl(aq) solution was a better conductor. A 0.1 M  $C_6H_{12}O_6$ (aq) solution was also tested. During this laboratory activity, appropriate safety equipment was used and safety procedures were followed.

- 10 State, in terms of the concentration of ions, why the 6.0 M HCl(aq) is a better conductor of electricity than the 0.1 M HCl(aq).

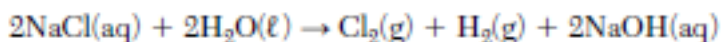
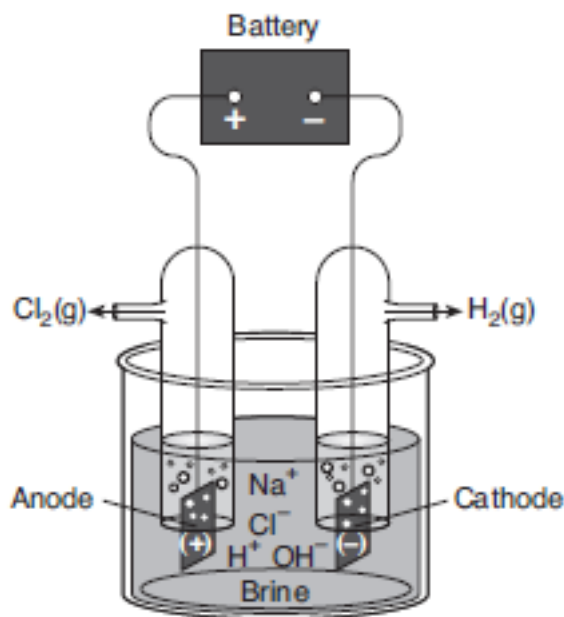
Base your answers to questions 11 on the information below and on your knowledge of chemistry.

In a laboratory investigation, an HCl(aq) solution with a pH value of 2 is used to determine the molarity of a KOH(aq) solution. A 7.5-milliliter sample of the KOH(aq) is exactly neutralized by 15.0 milliliters of the 0.010 M HCl(aq). During this laboratory activity, appropriate safety equipment is used and safety procedures are followed.

- 11 Explain, in terms of aqueous ions, why 15.0 mL of a 1.0 M HCl(aq) solution is a better conductor of electricity than 15.0 mL of a 0.010 M HCl(aq) solution.

Base your answers to questions 12 on the information below and on your knowledge of chemistry.

The electrolysis of brine, a concentrated aqueous sodium chloride solution, produces three important industrial chemicals: chlorine gas, hydrogen gas, and sodium hydroxide. The diagram and equation below represent a brine electrolysis cell. Before the battery is connected, the pH value of the brine solution is 7.0.



- 12 Explain, in terms of ions, why the aqueous solution in the cell conducts an electric current.

Base your answers to questions 13 on the information below and on your knowledge of chemistry.

Vinegar is a commercial form of acetic acid, HC<sub>2</sub>H<sub>3</sub>O<sub>2</sub>(aq). One sample of vinegar has a pH value of 2.4.

- 13 Explain, in terms of particles, why HC<sub>2</sub>H<sub>3</sub>O<sub>2</sub>(aq) can conduct an electric current.

Base your answers to questions 14 on the information below and on your knowledge of chemistry.

In an investigation, aqueous solutions are prepared by completely dissolving a different amount of NaCl(s) in each of four beakers containing 100.00 grams of H<sub>2</sub>O(l) at room temperature. Each solution is heated and the temperature at which boiling occurred is measured. The data are recorded in the table below.

Boiling Point Data for Four NaCl(aq) Solutions

Beaker Number	Mass of H <sub>2</sub> O(l) (g)	Mass of NaCl(s) Dissolved (g)	Boiling Point of Solution (°C)
1	100.00	8.76	101.5
2	100.00	17.52	103.1
3	100.00	26.28	104.6
4	100.00	35.04	106.1

- 14 Explain, in terms of ions, why the ability to conduct an electric current is greater for the solution in beaker 4 than for the solution in beaker 1.

Base your answers to questions 15 on the information below and on your knowledge of chemistry.

A laboratory technician is given the table below and a sample of one of the three substances listed in the table. The technician makes an aqueous solution with a portion of the sample. When a conductivity tester is lowered into the solution, the lightbulb on the tester glows brightly. Another portion of the sample is placed in a heat-resistant container that is placed in an oven at 450.°C. The sample melts.

Some Properties of Three Substances

Property	Substance		
	Sodium nitrate	Potassium chromate	Sulfur
solubility in water at 20. °C	soluble	soluble	insoluble
electrical conductivity of aqueous solution	good	good	not applicable
melting point (°C)	307	974	115

- 15 Explain, in terms of ions, why an aqueous solution of potassium chromate conducts an electric current.

## Answer Keys

- 1 4
- 2 3
- 3 3
- 4 4
- 5 4
- 6 4
- 7 3
- 8 4
- 9 1

10 Allow 1 credit. Acceptable responses include, but are not limited to:

- There is a greater concentration of ions present in the 6.0 M HCl(aq) than in the 0.1 M HCl(aq).
- The 6.0 M HCl(aq) has a higher concentration of ions.
- Note: Do not allow credit for “more ions” because it is not in terms of concentrations of ions.

11 Allow 1 credit. Acceptable responses include, but are not limited to:

- The 1.0 M solution has a greater concentration of mobile ions than the 0.010 M solution.
- The 0.010 M solution has fewer mobile ions.
- The 1.0 M solution has more aqueous ions.

12 Allow 1 credit. Acceptable responses include, but are not limited to:

- The solution contains mobile ions.
- The solution has ions that can move.
- The  $\text{Na}^+(\text{aq})$  and  $\text{Cl}^-(\text{aq})$  move freely.

13 Allow 1 credit. Acceptable responses include, but are not limited to:

- The  $\text{HC}_2\text{H}_3\text{O}_2(\text{aq})$  has ions in water, which are mobile.
- The charged particles move freely.
- Acetic acid forms moveable ions in aqueous solution.

14 Allow 1 credit. Acceptable responses include, but are not limited to:

- The solution in beaker 4 has a greater ability to conduct an electric current because it has a greater concentration of aqueous ions than the solution in beaker 1.
- There are fewer charged particles free to move in beaker 1.
- There are more ions in beaker 4.

15 Allow 1 credit. Acceptable responses include, but are not limited to:

- An aqueous solution of potassium chromate has mobile ions that conduct electricity.
- The  $\text{K}_2\text{CrO}_4$  dissociated into mobile ions.
- Aqueous potassium chromate has charged particles that can move.
- The  $\text{K}^+(\text{aq})$  and  $\text{CrO}_4^{2-}(\text{aq})$  move freely.