

# LAQUA



pH	ORP	Ion	Conductivity
Resistivity	Total Dissolved Solids	Salinity	

## ELECTRODES



[www.horiba-laqua.com](http://www.horiba-laqua.com)



# LAQUA Electrode Technology

Born from the fusion of our technical expertise and state-of-the-art manufacturing

As a leading pH electrode manufacturer, HORIBA uses the latest technology for all your measurement needs.

Since the development of Japan's first glass electrode for pH meter, HORIBA has focused on continually improving our electrode technology, especially in materials and manufacturing. HORIBA is committed to continually explore and employ groundbreaking solutions in manufacturing next-generation electrodes so that we always provide you with the newest and best electrodes.



## pH Electrode Selection Guide

		3-in-1 ELECTRODES												COMBINATION ELECTRODES			
		PLASTIC					STANDARD ToupH	LONG ToupH	MICRO ToupH	SLEEVE ToupH	SLEEVE	NON-AQUEOUS	NEEDLE	PLASTIC	STANDARD ToupH	MICRO ToupH	SLEEVE ToupH
		9651-10D	9625-10D	9630-10D	9631-10D	9632-10D	9615S-10D	9680S-10D	9618S-10D	9681S-10D	6367-10D	6377-10D	6252-10D	9425-10C	9415-10C	9418-10C	9481-10C
Specification	Applicable temperature range (°C)	0-60	0-100	0-100	0-60	0-100	0-100	0-100	0-60	0-60	0-60	0-60	0-60	0-100	0-100	0-60	0-60
	Diameter (mm)	16	16	16	16	16	12	8	3	12	12	12	12	16	12	3	12
	Length (mm)	150	150	150	155	150	198	283	185	203	150	150	150	150	198	185	203

## pH - Sample Conditions

Aqueous Solution	Conductivity	Normal (over 100 mS/m)	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
		Low (approx. 10 ~100 mS/m)			●							○	●					○
		Very low (approx. 5 ~100 mS/m)			○							○	●					○
		High (approx. 5 S/m)	○	○	○	○	○	○	○	○	●				○	○		●
	Strong alkaline (pH 10-12)					●	○	○		○	○				○		○	
	Strong acidity (pH 0-2) * Except HF sample				●		●								●			
	Quick heat change (within 50°C)	●	●	●	●	●								●				
	High viscosity (approx. 5 Pa·S)										●	○	●					●
	Containing non-aqueous solvent						○	○	○	○	○	○	●		○	○	○	○
Suspension						○	○	○	○	●		●		○	○	○	●	
Solid/Semisolid	Inside												○					
	Surface																	

Sample Containers	Microtube/plate (> 50 µL)									●							●
	Ampule > ø4 mm									●							●
	Micro container (> 2 mL)								○	●							●
	Tube ID:13 mm, L:100 ~ 150 mm								●								
	Beaker 10 mL - 1 L	●	●	●	●	●	●	○	○	○	○	○	○	○	○	○	○
	Large container (> 1 L)	○	○	○	○	○	○	●						○	○		
	Petri dish																
Droplet																	

Water	Pure/ion-exchange water (approx. 0.1 mS/m)/ Distilled water (approx. 0.5 mS/m)						○					●		○			
	Tap/drinking water (approx. 10 mS/m)	○	○	●			○			○		●		○	○		○
	Surface water			●			○			○		●		○			○
Chemical reagent/solvent	Pharmaceutical water/ Environmental water/acid rain	○	○	○			○			○		○		○	○		○
	Caustic/strong acid (Except HF sample)				●		●			○					●		○
	Hydrofluoric acid				●												
	Surfactant						○				●		○		○		●
Pharmaceutical/biological sample	Water-based paint						○				●		○		○		●
	Dye/coloring agent						○				●		○		○		●
	Protein-containing sample						○		○	○	○			○	○		○
	Medicinal preparation								○	○	○				○		○
	Enzyme solution								○	○	○		○			○	○
Food	Tris buffer						●		○	○				○		○	○
	Suspension						○			○		●		○	○		○
	Agar medium																
	Jam						○			○		○		○			○
	Meat/fish/Fruit/vegetable/Dough												○				
Beverage/seasoning	Honey											●					
	Cheese/butter																
	Yogurt	○	○	○			○			○	○		○	○	○		○
	Beer	○	○	○			○			○	○		○	○	○		○
Cosmetic/lotion	Milk/Carbonated drink/juice/sauce/soy sauce						○			○		○		○			○
	Mayonnaise/ketchup						○			○		○		○			○
	Beauty cream/mascara						○			○		○		○			○
	Gel/soap/shampoo/Hairdye lotion						○			○		○		○			○
Emulsified liquid						○			○		○		○			○	

● Recommended ○ Can be measured

# pH Combination Electrodes

HORIBA pH Combination electrodes manufactured with 1 meter cable terminating in BNC connector allow these electrodes to be used with any pH meter<sup>1</sup>. Enjoy the full spectrum of features and benefits of these electrodes on your existing pH meter<sup>1</sup>. (For applications where temperature measurement and compensation is required, please refer to the 3-in-1 pH electrodes).

<sup>1</sup>pH meters must have BNC connector

Type	pH Range	Operating Temperature Range (°C)	Liquid Junction	Application
<p><b>9415-10C</b> General laboratory application <b>ToupH Standard ToupH electrode</b></p>  <p>3200611623</p> <p>Overall length: 198 mm Diameter of probe: 12 mm Connector: BNC</p>	0-14	0-100	Ceramic	<p>The electrode offers quick stability and drift reduction.</p> <ul style="list-style-type: none"> <li>Constructed with responsive glass that is 10X stronger than JIS standards</li> <li>The one-touch refilling port slider allows one-hand operation</li> <li>Waterproof, Pb-free glass</li> </ul> <p>Perfect for preparing pH buffers and other aqueous test solutions.</p>
<p><b>9425-10C</b> General field application <b>Field plastic electrode</b></p>  <p>3200611625</p> <p>Overall length: 150 mm Diameter of probe: 16 mm Connector: BNC</p>	0-14	0-100	Ceramic	<p>The electrode has plastic body, which is ideal for field measurement.</p> <ul style="list-style-type: none"> <li>Can be submerged up to 1m depth and 30mins (with refilling port closed)</li> <li>Waterproof, Pb-free glass</li> </ul> <p>Recommended for field use. For measurement of tap water and drinking water.</p>
<p><b>9481-10C</b> High viscosity application <b>ToupH Sleeve ToupH electrode</b></p>  <p>3200611631</p> <p>Overall length: 203 mm Diameter of probe: 12 mm Connector: BNC</p>	0-14	0-60	Movable sleeve	<p>The electrode gives stable readings in highly viscous samples.</p> <ul style="list-style-type: none"> <li>The liquid junction is designed with a movable sleeve that can be cleaned easily and prevents clogging</li> <li>Waterproof, Pb-free glass</li> </ul> <p>For measurement of highly viscous samples and samples containing non-aqueous solvents (e.g., cosmetics, paints).</p>
<p><b>9418-10C</b> Precious trace amount sample <b>ToupH Micro ToupH electrode</b></p>  <p>3200611627</p> <p>Overall length: 185 mm Diameter of probe: 3 mm Connector: BNC</p>	0-14	0-60	Ceramic	<p>The electrode can measure samples as small as 50µL.</p> <ul style="list-style-type: none"> <li>Compatible with extremely small containers (e.g., micro tubes)</li> <li>Temperature sensor is placed next to the bulb for quick response</li> <li>Waterproof</li> </ul> <p>Suitable for low-volume samples and wide range of aqueous solutions.</p>
<p><b>9480-10C</b> For large containers and long test tubes <b>ToupH Long ToupH electrode</b></p>  <p>3200611628</p> <p>Overall length: 283 mm Diameter of probe: 8 mm Connector: BNC</p>	0-14	0-100	Ceramic	<p>The long, thin body of the electrode is perfect for large containers and test tubes.</p> <ul style="list-style-type: none"> <li>283mm length, 8mm diameter</li> <li>Constructed with responsive glass that is 10X stronger than JIS standards</li> <li>Waterproof, Pb-free glass</li> </ul> <p>For measuring samples (e.g., microbial culture fluids) in test tubes and tall beakers.</p>
<p><b>6069-10C</b> For very slender test tubes</p>  <p>3014081107</p> <p>Overall length: 291 mm Diameter of probe: 3.15 mm Connector: BNC</p>	0-14	0-60	Ceramic	<p>The long, thin body of the electrode is perfect for very slender test tubes.</p> <ul style="list-style-type: none"> <li>291mm length, 3mm diameter</li> <li>Waterproof</li> </ul> <p>For measuring samples in slender tubes (e.g., NMR test tube).</p>

Type	pH Range	Operating Temperature Range (°C)	Liquid Junction	Application
<b>6261-10C</b> Flat type  3014081807 Overall length: 150 mm Diameter of probe: 12 mm Connector: BNC	0-12	0-50	Sleeve	The sensor is located on the flat surface of the tip. <ul style="list-style-type: none"> <li>• Measurement can be made from minute amount of moisture on solid sample surface</li> <li>• Pure water can be applied for samples with no moisture</li> <li>• Waterproof</li> </ul> Perfect for measuring samples in shallow containers (e.g., petri dishes) and gelatinous materials (e.g., nutrient agar). For surface measurement of meat, paper, skin, and cloth.

## 3-in-1 pH Glass Body Electrodes<sup>2</sup>

HORIBA pH Combination electrodes with an integrated thermistor offer higher accuracy as these electrodes measure temperature concurrently with pH. The pH meter is able to continuously monitor and compensate for temperature effects automatically.

<sup>2</sup>Only compatible with HORIBA pH meters

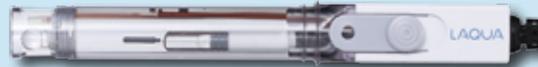
Type	pH Range	Operating Temperature Range (°C)	Liquid Junction	Application
<b>9615S-10D</b> General laboratory application <b>ToupH Standard ToupH electrode</b>  3200585428 Overall length: 198 mm Diameter of probe: 12 mm Connectors: BNC & phono jack	0-14	0-100	Ceramic	The electrode offers quick stability and drift reduction. <ul style="list-style-type: none"> <li>• Constructed with responsive glass that is 10x stronger than JIS standards</li> <li>• The one-touch refilling port slider allows one-hand operation</li> <li>• Waterproof, Pb-free glass</li> </ul> Perfect for preparing pH buffers and other aqueous test solutions.
<b>9681S-10D</b> High viscosity application <b>ToupH Sleeve ToupH electrode</b>  3200585463 Overall length: 203 mm Diameter of probe: 12 mm Connectors: BNC & phono jack	0-14	0-60	Movable sleeve	The electrode gives stable readings in highly viscous samples. <ul style="list-style-type: none"> <li>• The liquid junction is designed with a movable sleeve that can be cleaned easily and prevents clogging</li> <li>• Waterproof, Pb-free glass</li> </ul> For measurement of highly viscous samples and samples containing non-aqueous solvents (e.g. cosmetics, paints).
<b>9618S-10D</b> Precious trace amount sample <b>ToupH Micro ToupH electrode</b>  3200585447 Overall length: 185 mm Diameter of probe: 3 mm Connectors: BNC & phono jack	0-14	0-60	Ceramic	The electrode can measure samples as small as 50µL. <ul style="list-style-type: none"> <li>• Compatible with extremely small containers (e.g. micro tubes)</li> <li>• Temperature sensor is placed next to the bulb for quick response</li> <li>• Waterproof</li> </ul> Suitable for low-volume samples and a wide range of aqueous solutions.
<b>9680S-10D</b> For large containers and long test tubes <b>ToupH Long ToupH electrode</b>  3200585428 Overall length: 283 mm Diameter of probe: 8 mm Connectors: BNC & phono jack	0-14	0-100	Ceramic	The long, thin body of the electrode is perfect for large containers and test tubes. <ul style="list-style-type: none"> <li>• 283mm length, 8mm diameter</li> <li>• Constructed with responsive glass that is 10x stronger than JIS standards</li> <li>• Waterproof, Pb-free glass</li> </ul> For measuring samples (e.g. microbial culture fluids) in test tubes and tall beakers.

Continued on the next page

Type	pH Range	Operating Temperature Range (°C)	Liquid Junction	Application
<b>6252-10D</b> For food application (needle type)  Overall length: 150 mm Diameter of probe: 12 mm Connectors: BNC & phono jack 3014080850	0-12	0-60	Ceramic	Needle electrode allows measurement of food samples and aqueous solutions.
<b>6377-10D</b> For measurement of low-conductivity water and non-aqueous solvents  Overall length: 150 mm Diameter of probe: 12 mm Connectors: BNC & phono jack 3014093085	0-14	0-60	Movable sleeve	Uses a glass membrane that is highly sensitive to low-conductivity water and non-aqueous solvents.
<b>6367-10D</b> Standard type (sleeve)  Overall length: 150 mm Diameter of probe: 12 mm Connectors: BNC & phono jack 3014079136	0-14	0-60	Sleeve	Uses a sleeve at the liquid junction for improved stability and repeatability. For measuring pH at high accuracy.

## 3-in-1 pH Plastic Body Electrodes<sup>2</sup>

<sup>2</sup>Only compatible with HORIBA pH meters

Type	pH Range	Operating Temperature Range (°C)	Liquid Junction	Applications
<b>9651-10D</b> Gel-filled pH electrode  Overall length: 150 mm Diameter of probe: 16 mm Connectors: BNC & phono jack 3200642020	0-14	0-60	Porous sintered polyethylene	The plastic body of the electrode is filled with gel electrolyte. Less maintenance is needed as refilling is not required. <ul style="list-style-type: none"> <li>Can be submerged up to 1m depth of water for 30mins.</li> <li>Waterproof, Pb-free glass</li> </ul> Recommended for field use.
<b>9625-10D; 9625-20D; 9625-30D</b> Standard type  Overall length: 150 mm Diameter of probe: 16 mm Connectors: BNC & phono jack 3200360505; 3200393025; 3200393026	0-14	0-100	Ceramic	The electrode has a plastic body which is ideal for field measurement. <ul style="list-style-type: none"> <li>Can be submerged up to 1m depth of water for 30mins. (with refilling port closed)</li> <li>Waterproof, Pb-free glass</li> </ul> Recommended for field use. For measurement of tap water and drinking water.
<b>9631-10D</b> Hydrofluoric acid resistant electrode  Overall length: 155 mm Diameter of probe: 16 mm Connectors: BNC & phono jack 3200524119	2-12	0-60	Ceramic	The electrode can measure 1% hydrofluoric acid solution (at 25°C, immersed at 1min.) for about 1000 times. <ul style="list-style-type: none"> <li>Rolled glass design for long-term reliable measurement and easy maintenance</li> <li>Compliant with Japan's Measurement Act Certification</li> <li>Waterproof, Pb-free glass</li> </ul> Suitable for drain water measurement after etching process.
<b>9632-10D</b> Strong alkali resistant electrode  Overall length: 150 mm Diameter of probe: 16 mm Connectors: BNC & phono jack 3200524120	0-14	0-100	Ceramic	The alkali-resistant glass membrane has higher resistance and longer stability (about 5X in 0.1mol/L sodium at 60°C, pH 13) than conventional electrodes. <ul style="list-style-type: none"> <li>Waterproof, Pb-free glass</li> </ul> Suitable for strong alkali samples such as plating solutions.
<b>9630-10D</b> For tap water  Overall length: 150 mm Diameter of probe: 16 mm Connectors: BNC & phono jack 3200528726	0-14	0-100	Ceramic	The electrode can measure samples with low conductivity or buffering capacity. <ul style="list-style-type: none"> <li>Made of high purity multicomponent lithium series glass</li> <li>Waterproof, Pb-free glass</li> </ul> Suitable for tap water measurement and quality control in water purification plant. Recommended to use with cleaning solution 230.

# Next-Generation Electrode Technology

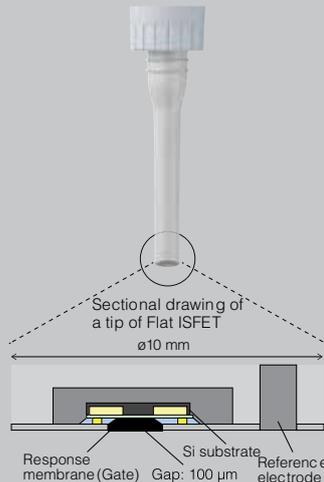
Semiconductor technology without glass

HORIBA started researching ISFET (Ion Sensitive Field Effect Transistor) using semiconductor technology many years ago and continued to improve its quality. This has provided a new solution for environments where glass material cannot be used.



**ISFET**

Applicable electrode: 0040-10D



## What is an ISFET (semiconductor sensor)?

ISFET is the abbreviation of Ion Sensitive Field Effect Transistor. The response part uses a semiconductor based sensor.

Special features of the ISFET

1. Will not crack or break like conventional glass electrodes
2. The sensor is flat and very small enabling the measurement of extremely small samples
3. Easy handling and maintenance - simply clean with a toothbrush
4. Can be stored dry

The flat electrode has a distance of less than 100 µm between the housing and sensor

The unique structure allows measurements to be taken from the smallest amount of moisture on solid objects and prevents bubbles being trapped on the sensor when measuring samples in a beaker.

## Reduction of static electricity effect

The combination of HORIBA's unique semiconductor device structure together with the improved electrostatic protection circuit results in a significant reduction of the static electricity effect that had previously been the weak point of a semiconductor sensor.

## ISFET ELECTRODES ISFET

ISFET is the abbreviation of Ion Sensitive Field Effect Transistor. Since ISFET is robust and will not crack like the conventional glass electrodes, it can be easily handled and maintained. The response part is equipped with a flat and miniature semiconductor-based sensor, which makes the measurement even on extremely small samples possible. Combination of HORIBA's unique semiconductor device structure and improvement of the electrostatic protection circuit enables to reduce greatly the static electricity effect that had been the weak point of the semiconductor sensor. Now the measurement has become more comfortable and reliable.

Type	pH Range	Operating Temperature Range (°C)	Liquid Junction	Applications
<b>0040-10D</b> General ISFET pH electrode  3200367925 Overall length: 190.6 mm Diameter of probe: 16 mm Connectors: BNC & phono jack	0-14	0-60	Porous sintered polyethylene	The sensor is located on the flat surface of the tip (<100µm from the housing). <ul style="list-style-type: none"> <li>• Measurement can be made from minute amount of moisture on solid sample surface</li> <li>• Pure water can be applied for samples with no moisture</li> <li>• Use of semiconductor sensor prevents damage such as crack or breakage</li> <li>• Waterproof</li> <li>• Replacement sensor (0141) 3200367926</li> </ul> Perfect for measuring samples in shallow containers (e.g., petri dishes) and gelatinous materials (e.g., nutrient agar). For surface measurement of meat, paper, skin, and cloth.

## Metallic Electrode (For ORP Measurement)

Type	Operating Temperature Range (°C)	Electrode Material	Internal Solution	Applications
<b>9300-10D</b> Waterproof platinum combination type  3014046710 Overall length: 150 mm Diameter of probe: 12 mm Connector: BNC	0-60	Pt	#300 (KCl)	Waterproof. Flat platinum sensor allows measurement of low-volume samples.

# Combination ISE

Ion-selective electrodes are responsive to concentration of particular ions in the test liquid and are variable-potential electrodes. They are used in conjunction with reference electrodes to measure the concentration of particular ions. HORIBA's years of experience and know-how in this field are behind the wide range of ion electrodes we offer.

When measurements are made using an ion meter, calibrating it with various standard solutions will give direct readings of the ion concentration. Note that since volume-detection level changes with temperature, measurements must be taken at a fixed temperature.

Type	Measurement Range	Selection Coefficient
<p>Ammonia ion electrode (combination) <b>5002A-10C</b></p>  <p>3014093560</p> <p>Overall length: 161 mm Diameter of probe: 15 mm Connector: BNC</p>	<ol style="list-style-type: none"> <li>0.1 to 1,000 mg/L NH<sub>3</sub></li> <li>Adjust more than pH 12</li> <li>0 to 50°C</li> <li>Within 30 seconds when substituting low concentration to high concentration Within 2 minutes when substituting high concentration to low concentration</li> </ol>	<p>_____</p>
<p>Chloride ion electrode (combination) <b>6560-10C</b></p>  <p>3014093430</p> <p>Overall length: 150 mm Diameter of probe: 16 mm Connector: BNC</p>	<ol style="list-style-type: none"> <li>0.35 to 35,000 mg/L Cl<sup>-</sup> (10<sup>-5</sup> to 1 mol/L Cl<sup>-</sup>)</li> <li>350 mg/L (10<sup>-2</sup> mol/L) Cl<sup>-</sup>, pH 3 to 11</li> <li>0 to 50°C</li> <li>Within 5 seconds</li> </ol>	<p>S<sub>2</sub>O<sub>3</sub><sup>2-</sup>, S<sup>2-</sup>, I<sup>-</sup>, Ag<sup>+</sup>, Hg<sup>2+</sup> = Not acceptable SCN<sup>-</sup> = 0.3, MnO<sub>4</sub><sup>-</sup> = 0.1 Br<sup>-</sup> = 0.03 NO<sub>3</sub><sup>-</sup>, F<sup>-</sup>, HCO<sub>3</sub><sup>-</sup>, SO<sub>4</sub><sup>2-</sup>, PO<sub>4</sub><sup>2-</sup> = 1,000</p>
<p>Fluoride ion electrode (combination) <b>6561-10C</b></p>  <p>3014093431</p> <p>Overall length: 150 mm Diameter of probe: 16 mm Connector: BNC</p>	<ol style="list-style-type: none"> <li>0.02 to 19,000 mg/L F<sup>-</sup> (10<sup>-6</sup> to 1 mol/L F<sup>-</sup>)</li> <li>20 mg/L (10<sup>-3</sup> mol/L) F<sup>-</sup>, pH 4 to 10</li> <li>0 to 50°C</li> <li>Within 5 seconds</li> </ol>	<p>Possible interference when multiply-charged ion (ex. Al<sup>3+</sup>, Fe<sup>3+</sup>) coexisted and foamed the complex.</p>
<p>Nitrate ion electrode (combination) <b>6581-10C</b></p>  <p>3014093432</p> <p>Overall length: 150 mm Diameter of probe: 16 mm Connector: BNC</p>	<ol style="list-style-type: none"> <li>0.62 to 62,000 mg/L NO<sub>3</sub><sup>-</sup> (10<sup>-5</sup> to 1 mol/L NO<sub>3</sub><sup>-</sup>)</li> <li>62 mg/L (10<sup>-3</sup> mol/L) NO<sub>3</sub><sup>-</sup>, pH 3 to 7</li> <li>0 to 50°C</li> <li>Within 15 seconds</li> </ol>	<p>ClO<sub>4</sub><sup>-</sup> = 0.03, I<sup>-</sup> = 0.1, Br<sup>-</sup> = 2 NO<sub>2</sub><sup>-</sup> = 3, Cl<sup>-</sup> = 40, F<sup>-</sup> = 200 CH<sub>3</sub>COO<sup>-</sup> = 300, SO<sub>4</sub><sup>2-</sup> = over 1,000</p>
<p>Potassium ion electrode (combination) <b>6582-10C</b></p>  <p>3014093433</p> <p>Overall length: 150 mm Diameter of probe: 16 mm Connector: BNC</p>	<ol style="list-style-type: none"> <li>0.04 to 39,000 mg/L K<sup>+</sup> (10<sup>-6</sup> to 1 mol/L K<sup>+</sup>)</li> <li>3.9 mg/L (10<sup>-4</sup> mol/L) K<sup>+</sup>, pH 5 to 11</li> <li>0 to 50°C</li> <li>Within 15 seconds</li> </ol>	<p>Rb<sup>+</sup> = 0.4, Cs<sup>+</sup> = 3, NH<sub>4</sub><sup>+</sup> = 70 Li<sup>+</sup>, Na<sup>+</sup>, Mg<sup>2+</sup>, Ca<sup>2+</sup>, Sr<sup>2+</sup>, Ba<sup>2+</sup> = over 1,000</p>
<p>Calcium ion electrode (combination) <b>6583-10C</b></p>  <p>3014093434</p> <p>Overall length: 150 mm Diameter of probe: 16 mm Connector: BNC</p>	<ol style="list-style-type: none"> <li>0.4 to 40,080 mg/L Ca<sup>2+</sup> (10<sup>-5</sup> to 1 mol/L Ca<sup>2+</sup>)</li> <li>4.0 mg/L (10<sup>-4</sup> mol/L) Ca<sup>2+</sup>, pH 5 to 11</li> <li>0 to 50°C</li> <li>Within 15 seconds</li> </ol>	<p>Fe<sup>3+</sup> = 0.1, Fe<sup>2+</sup>, Zn<sup>2+</sup> = 1, Sr<sup>2+</sup> = 50 Ni<sup>2+</sup>, Cu<sup>2+</sup> = 70, Co<sup>2+</sup> = 350 Mn<sup>2+</sup> = 500, Mg<sup>2+</sup> = 1,000 Na<sup>+</sup>, K<sup>+</sup>, Ba<sup>2+</sup>, NH<sub>4</sub><sup>+</sup> = over 1,000</p>