In this learning activity, you are asked to complete the table by adding the missing information. You should first identify in the left-hand column whether the electrolyte is *intracellular* or *extracellular*. Then complete the right-hand column with the functions of the electrolyte and the *indications of imbalance* in either direction – *lower* or *higher* levels. In addition, if you can think of any issues related to IV infusion of the electrolyte, you should add those in the right-hand column.

<table>
<thead>
<tr>
<th>ELECTROLYTE</th>
<th>FUNCTION/INDICATIONS OF IMBALANCE</th>
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<tbody>
<tr>
<td>Potassium (K+)</td>
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<tr>
<td>Magnesium (Mg++)</td>
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<tr>
<td>Sodium (Na+)</td>
<td></td>
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<tr>
<td>Chloride (Cl-)</td>
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<tr>
<td>Bicarbonate (HCO3-)</td>
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<tr>
<td>Calcium (Ca+)</td>
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</table>
Answers for Electrolyte Table

Potassium (K+) (Intracellular)

The distribution of potassium between the intracellular and extracellular compartments regulates electrical membrane potentials controlling the excitability of nerve and muscle cells as well as the contractility of skeletal, cardiac, and smooth muscle tissue.

When levels of potassium are low (hypokalemia), signs and symptoms include dizziness, muscle weakness, leg cramps, cardiac arrhythmia, hypotension, thirst, nausea, anorexia, poorly concentrated urine, [and] polyuria.

When levels of potassium are high (hyperkalemia), signs and symptoms include nausea and vomiting, intestinal cramps, diarrhea, paresthesias, weakness, dizziness, muscle cramps, changes in electrocardiogram, [and] risk of cardiac arrest with severe excess.

Magnesium (Mg++) (Intracellular)

Magnesium acts as a cofactor in many intracellular enzyme reactions...[and] is essential to all reactions that require ATP, for every step related to replication and transcription of DNA, and for the translation of messenger RNA...[and] is required for cellular energy metabolism.

A low level of magnesium (hypomagnesemia) usually occurs in conjunction with hypocalcemia and hypokalemia, and signs and symptoms include personality change, athetoid or choreiform movements, nystagmus, tetany...tachycardia, hypertension, [and] cardiac arrhythmias.

When levels of magnesium are high (hypermagnesemia), signs and symptoms include lethargy, hyporeflexia, confusion, coma, hypotension, cardiac arrhythmias, [and] cardiac arrest.

Sodium (Na+) (Extracellular)

Sodium serves as the primary determinant of blood osmolality. It is also important in regulating acid-base balance...[and] contributes to the function of the nervous system and other excitable tissue.

When levels of sodium are low (hyponatremia), signs and symptoms include muscle cramps, weakness, headache, depression, apprehension, feeling of impending doom, personality changes, lethargy, stupor, coma, anorexia, nausea, vomiting, abdominal cramps, [and] diarrhea.

When levels of sodium are high (hypernatremia), signs and symptoms include polydipsia, oliguria or anuria, high urine specific gravity, dry skin and mucous membranes, decreased tissue turgor, tongue rough and fissured, decreased salivation and lacrimation, headache, agitation, restlessness, decreased reflexes, seizures and coma, tachycardia, weak and thready pulse, decreased blood pressure, [and] vascular collapse.
**Chloride (Cl-) (Extracellular)**

Chloride movement is often associated with sodium and plays a role in regulation of acid-base balance.

When levels of chloride are low (hypochloremia), signs and symptoms include increased muscle tone, twitching, weakness, tetany, shallow, depressed breathing, respiratory arrest, [and] mental confusion.

When levels of chloride are high (hyperchloremia), signs and symptoms include hyperchloremic metabolic acidosis, deep, rapid breathing, weakness, headache, diminished cognitive ability, [and] cardiac arrest.

**Bicarbonate (HCO3-) (Extracellular)**

One of the primary ways in which the body maintains a normal pH range is through chemical buffers in the ICF and ECF, the most important of which is the HCO$_3^-$ buffer system...A reduction in pH due to a decrease in HCO$_3^-$ is called *metabolic acidosis*, and an elevation in pH due to increased HCO$_3^-$ levels is called *metabolic alkalosis*.

Signs and symptoms of metabolic acidosis include anorexia, nausea and vomiting, abdominal pain, weakness, lethargy, general malaise, confusion, stupor, coma, depression of vital functions, peripheral vasodilation, decreased heart rate, cardiac arrhythmias, [skin] warm and flushed...[and] bone disease (e.g., chronic acidosis).

Signs and symptoms of metabolic alkalosis include confusion, hyperactive reflexes, tetany, convulsions, hypotension, arrhythmias, and respiratory acidosis due to decreased respiratory rate.

**Calcium (Ca+) (Extracellular)**

Calcium provides strength and stability for the skeletal system and serves as an exchangeable source to maintain extracellular calcium levels. It plays an essential role in many metabolic processes, including activity of enzyme systems, generation of action potentials, and muscle contraction.

When levels of calcium are high (hypocalcemia), signs and symptoms include paresthesias, especially numbness and tingling, skeletal muscle cramps, abdominal spasms and cramps, hyperactive reflexes, carpopedal spasm, tetany, laryngeal spasm...hypotension, signs of cardiac insufficiency, failure to respond to drugs that act by calcium-mediated mechanisms...osteomalacia, bone pain, deformities, [and] fracture.

When levels of calcium are high (hypercalcemia), signs and symptoms include polyuria, polydipsia, flank pain, signs of acute and chronic renal insufficiency, signs of kidney stones, anorexia, nausea, vomiting, constipation, muscle weakness and atrophy, ataxia, loss of muscle tone, osteopenia, osteoporosis, lethargy, personality and behavioural changes, stupor and coma, hypertension, shortening of the QT interval, [and] atrioventricular block on electrocardiogram.