

A significantly hypokalemic and dehydrated 500-kg horse needs a high level of potassium chloride (KCl) supplementation.

$K^+$  typically should not be administered at a rate over 0.5 mEq/kg/hr. The KCl is 2 mEq/mL. Lactated ringers solution (LRS) contains 4 mEq  $K^+$ /L.

What is the approximate maximum amount of potassium chloride (KCl) that could be added to 10 L of LRS in order to run the fluids at 4 L/h?

Need more information	HIDE
About 500 mLs	HIDE
About 10 mLs	HIDE
About 300 mLs	HIDE
About 70 mLs	HIDE

## Correct

About 300 mLs of KCl can be added to 10 L of LRS if the maximum safe dose is 0.5 mEq/kg/hr.

This is a very important calculation because potassium supplementation can be fatal if done too quickly. Hyperkalemia raises the resting membrane potential of cells, causing a hyper-excitability state. This can result in muscle and nerve excitability, which can cause cardiac arrhythmias or ARREST.

Here's the calculation:

500 kg horse x 0.5 mEq/kg/hr = 250 mEq/hr of KCl is maximum safe dose

250 mEq/hr divided by 2 mEq/mL = 125 mLs/hr of KCl

At a rate of 4 L/hr, each 4L can contain 125 mLs of KCl

10L will take 2.5 hours to administer at a rate of 4 L/hr

So,  $125 \text{ mLs} \times 2.5 = 312.5 \text{ mLs}$  of 2 mEq/mL KCl can be in 10 L

The 10 L LRS contains 4 mEq/L = 40 mEq total. This is negligible in the calculation for a horse but is included below to show it.

Working backwards to check your work:

10 L = 10,000 mLs

Add 300 mLs of KCl So total volume to infuse is 10300 mLs

The concentration of this solution is 640 mEq KCl ((= 300 mLs of KCl x 2 mEq/mL) +

Add 300 mLs of KCl So total volume to infuse is 10300 mLs

The concentration of this solution is 640 mEq KCl ((= 300 mLs of KCl x 2 mEq/mL) + 40 mEq in the LRS)/10300 mLs = 0.06 mEq/mL

(note: try it - if you don't include the K<sup>+</sup> in the LRS, you still get 0.06 mEq/mL)

0.06 mEq/mL x 4000 mLs/hr = 242 mEq/hr...compare to first calculation: 500 kg horse x 0.5 mEq/kg/hr = 250 mEq/hr of KCl is maximum safe dose - so pretty close!

Refs: The Merck Vet Manual online and McCurnin's Clinical Textbook for Veterinary Technicians, 8th ed.

 **zukureview**  **SAVE & EXIT**

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You are comparing two sets of lab results from a dog. The **sodium** level is in mEq/L on one and in mmol/L on the other.

What is the conversion factor to change mEq/L of sodium to mmol/L of sodium?

- 4 HIDE
- 0.25 HIDE
- 1 HIDE
- 0.5 HIDE
- 2 HIDE

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## Correct

The conversion factor for sodium from mEq to mmol is 1. An equivalent is a unit that integrates charge and moles.

One equivalent signifies one mole of charges and can be calculated by **multiplying the number of moles of charged particles in the substance by its valence** (or amount of charge).

Thus, for ions with a +1 or -1 charge (e.g.,  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Cl}^-$ ), 1 mol = 1 equivalent (Eq) so 1 mmol = 1 mEq.

Refs: The Merck Veterinary Manual online and the Merck Professional Manual online.

Tap to switch to the Consumer Version



## Ready Reference Guides

By Manuals Staff

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In the **US**, most laboratory test results are reported in what are termed **conventional units**; the **rest of the world** reports results in **Systeme International d'Unités (SI)** or **international units (IU)**. The unit basis for SI is updated periodically by a panel.

Many SI units are the same as units used in the US system; however, **SI units for concentrations are not**. **SI concentrations are reported as moles (mol) or decimal fractions of a mole (eg, millimole, micromole) per unit volume in liters (L)**. Conventional units are reported as **mass** (eg, grams, milligrams) or **chemical equivalency** (eg, milliequivalents) **per unit volume**, which may be in liters or decimal fractions of liters (eg, deciliters, milliliters). Results reported in amount per **100 mL** (1 dL) are sometimes expressed as percent (eg, 10 mg/dL may be written as 10 mg%).

**Moles, milligrams, and milliequivalents:** A mole is an **Avogadro's number** ( $6.023 \times 10^{23}$ ) of elementary entities (eg, atoms, ions, molecules); **the mass of 1 mole of a substance is its atomic weight in grams (eg, 1 mole of sodium = 23 g, 1 mole of calcium = 40 g)**. Similarly, the mass of a given quantity of substance divided by its atomic weight gives the number of moles (eg, 20 g sodium =  $20/23$ , or 0.87, mol).

An equivalent is a unit that integrates charge and moles; 1 equivalent represents one mole of charges and is calculated by multiplying the number of moles of charged particles in a substance times the valence of that substance. Thus, **for ions with a +1 or -1 charge (eg, Na<sup>+</sup>, K<sup>+</sup>, Cl<sup>-</sup>), 1 mole is 1 equivalent ( $1 \times 1 = 1$ )**; **for ions with a +2 or -2 charge (eg, Ca<sup>2+</sup>), ½ mole is 1 equivalent ( $\frac{1}{2} \times 2 = 1$ )**, and so forth for other valence values. A milliequivalent (mEq) is 1/1000 of an equivalent.

**The following can be used to convert between mEq, mg, and mmol:**

$$\text{mEq} = \text{mg/formula wt} \times \text{valence} = \text{mmol} \times \text{valence}$$

$$\text{mg} = \text{mEq} \times \text{formula wt} / \text{valence} = \text{mmol} \times \text{formula wt}$$

$$\text{mmol} = \text{mg/formula wt} = \text{mEq/valence}$$

(Note: Formula wt = atomic or molecular wt.)

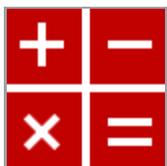
Alternatively, conversion tables are available in print and on the Internet.



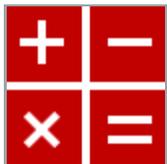
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[Weight Unit Conversions](#)



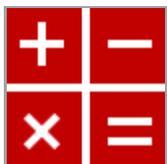
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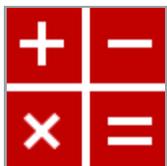
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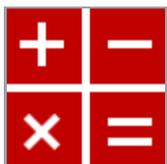
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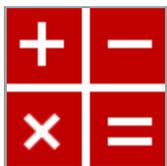
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### Metric System

Unit	Equivalent Subunit
Mass	

1 kilogram (kg)	1000 grams ( $10^3$ g)
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### Metric–Nonmetric Equivalents

Metric Unit	Equivalent Nonmetric Unit*
Liquid	
30 milliliters (mL)	1 fluid ounce (oz)

### Atomic Weight of Some Elements Important in Medicine

Element	Symbol	Atomic Weight*
Hydrogen	H	1
Carbon	C	12
Nitrogen	N	14

### Centigrade–Fahrenheit Equivalents\*

Application	°C	°F
Freezing for water at sea level	0	32
Clinical range	36.0	96.8
	36.5	97.7

## Resources In This Article



### Ready Reference Guides

Ready Reference Guides

Normal Laboratory  
Values

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## Also of Interest

### TEST YOUR Knowledge



**STUDENT**  
A MEDICAL EDUCATION

Which of the following best differentiates factitious disorder imposed on self from malingering?

- Patients with factitious disorder are sophisticated regarding medical practices.
- Patients with factitious disorder complain primarily of chest pain.
- Patients with factitious disorder have no external incentives for their behavior.
- Patients with factitious disorder have numerous abdominal scars.

AM I CORRECT?



Ashley



Kimi



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31 ✓

32 M ✗

33 ✓

34 ✓

35 ✓

36 ✗

37 M ✗

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You need to provide IV potassium supplementation in a hypokalemic horse (serum potassium, 2.2 mEq/L) weighing 450 kg. You remember that potassium should not be given at a rate over 0.5 mEq/kg/hour.

Which of the following is the absolute highest safe amount of KCl to add to 10 L of 0.9% NaCl for administration at a rate of 2L/hour to this horse?

1 mEq/L

HIDE

2250 mEq

HIDE

450 mEq/L

HIDE

1125 mEq

HIDE

Need more information

HIDE

The addition of 1125 mEq to 10 L (or 112.5 mEq/L) of KCl is the highest safe dose this horse can receive (at 0.5 mEq/kg/hour).

Calculation:

Maximum rate of KCl you can give the horse is 0.5mEq/kg/hr

This horse weighs 450 kg

$$450 \times 0.5 = 225 \text{ mEq}$$

225 mEq/hr is the maximum rate of KCl this horse can safely receive

If you are making up a 10L bag of saline and running it at 2L/hr, this bag will last 5 hours

$$225 \text{ mEq/hr} \times 5 \text{ hr} = 1125\text{mEq}$$