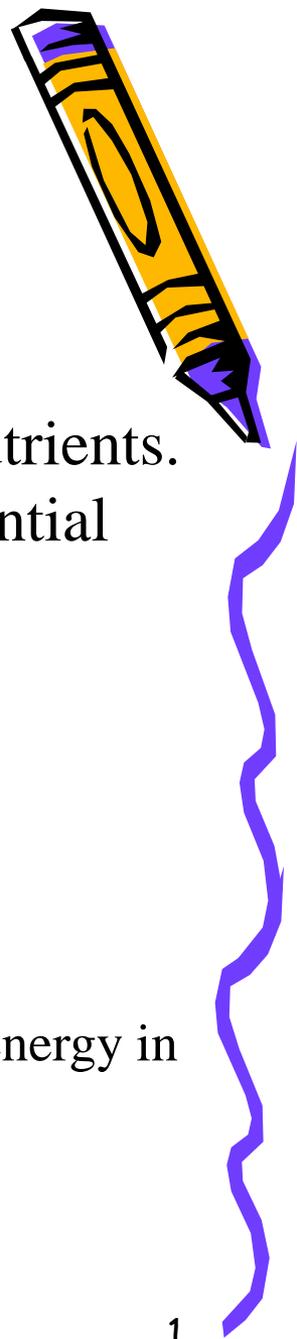


# The Importance of Minerals



## **Agricultural Education Standards:**

AS 11/12.3-5 Determine the sources and use of nutrients.

AS 11/12.3-6 Identify vitamins, minerals and essential amino acids, their sources and functions.

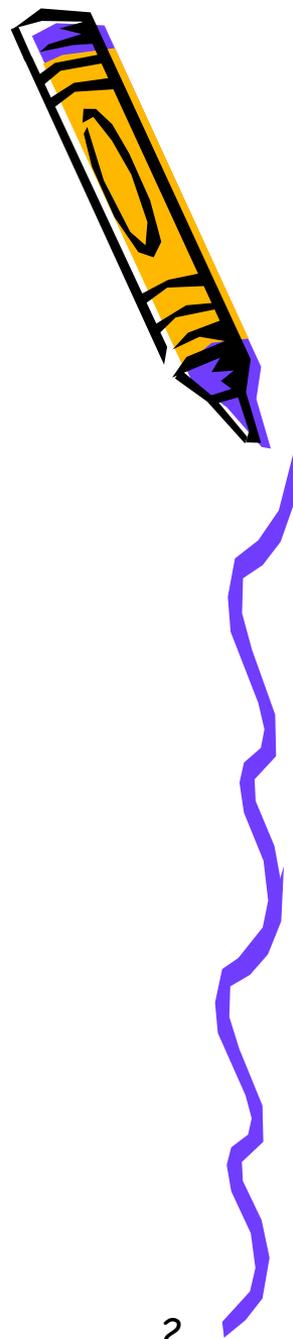
## **Colorado Science Standards:**

3.2 Student knows and understands interrelationships of matter and energy in living systems.



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# The Importance of Minerals



## Animal Minerals

- A. *Inorganic* substances that animals need in small amounts
- B. *Major (macro)*--Needed in larger amounts
- C. *Micro Minerals*- Needed in small amounts



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# Major/Macro Minerals

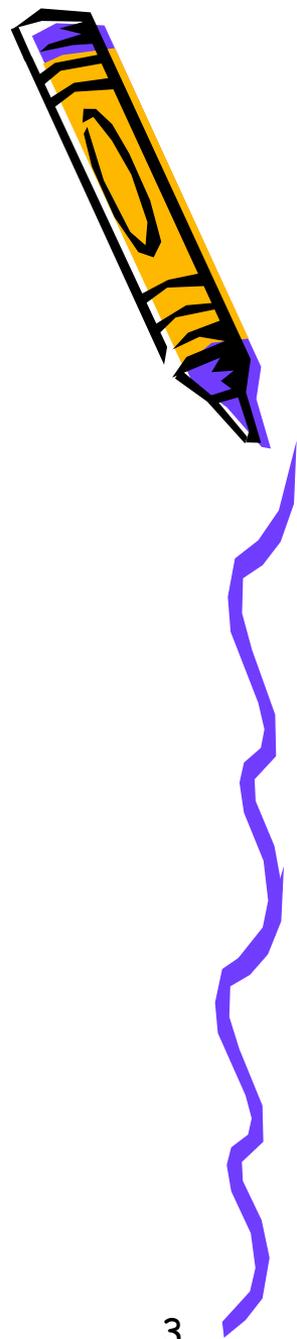
## Calcium

### 1. Functions

- a. Bone and teeth development
- b. Essential for lactating animals and laying hens
- c. Nerve and muscle function
- d. Maintain acid-based balance of body fluids

### 2. Deficiency symptoms

- a. Rickets
- b. Broken bones
- c. Slow growth
- d. Milk fever



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# Major/Macro Minerals

## Calcium

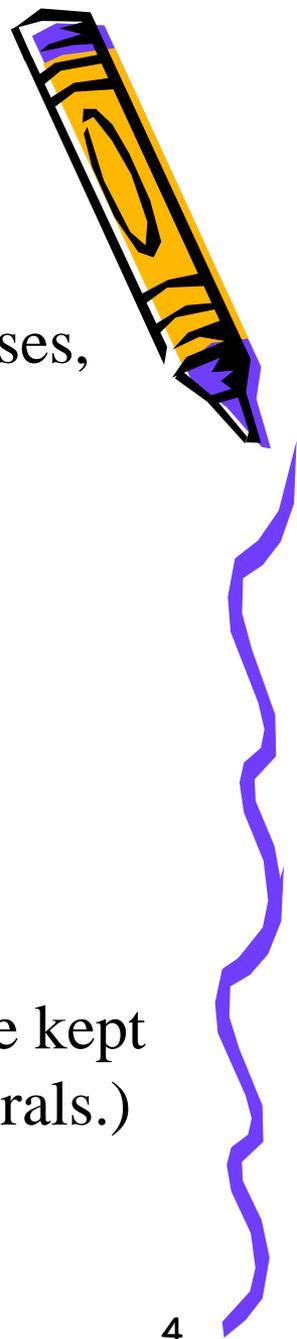
### 3. Sources

- a. Grains, grain by-products, straw, dried manure, grasses, protein supplements from plants
- b. Forages (grasses, legumes)
- c. Fish meal, milk, citrus pulp

### 4. Calcium Toxicity

- a. Decreased absorption of other minerals
- b. Calcification of soft body tissues
- c. Kidney stone formation

(Note: The calcium-phosphorus ratio in the feed must be kept between 1:1 to 2:1 for proper utilization of both minerals.)



# Major/Macro Minerals

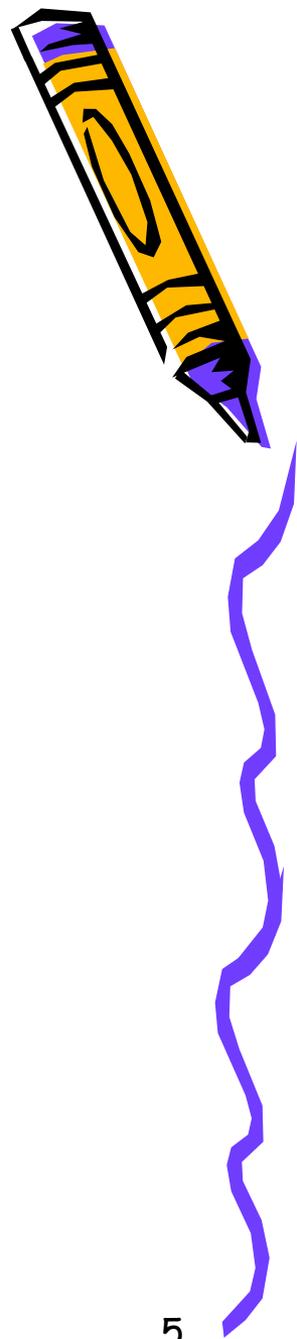
## Phosphorus

### 1. Functions

- a. Bone and teeth growth and development
- b. Appetite
- c. Milk and egg production
- d. Reproduction
- e. Conversion of carotene to vitamin A
- f. Vitamin D utilization

### 2. Deficiency symptoms

- a. Lameness
- b. Stiffness of joints
- c. Lowered appetite
- d. Reduced rate of gain
- e. Breeding problems

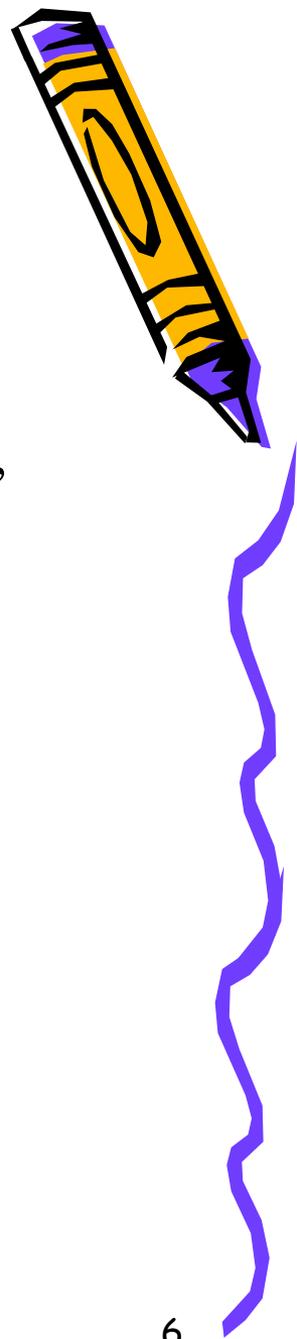


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# Major/Macro Minerals

## Phosphorus

3. **Sources**
  - a. Feeds such as wheat bran, meat scraps, tankage, fish meal, dried skim milk
  - b. Legume and grass pastures
  - c. Cereal grains and by-products
  - d. Mineral supplements



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# Major/Macro Minerals

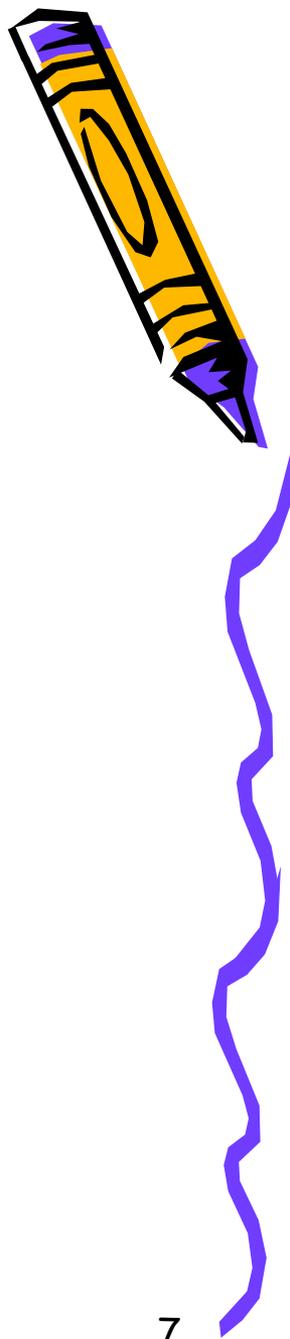
## Salt (sodium and chlorine)

### 1. Functions

- a. Maintain osmotic pressure in body cells
- b. Maintain neutral pH level in body tissues
- c. Muscle and nerve activity
- d. Formation of hydrochloric acid in digestive juices

### 2. Deficiency symptoms

- a. Lack of appetite
- b. Unthrifty appearance
- c. Reduced growth
- d. Lowered reproduction
- e. Eating soil



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# Major/Macro Minerals

## Salt (sodium and chlorine)

### 3. Sources

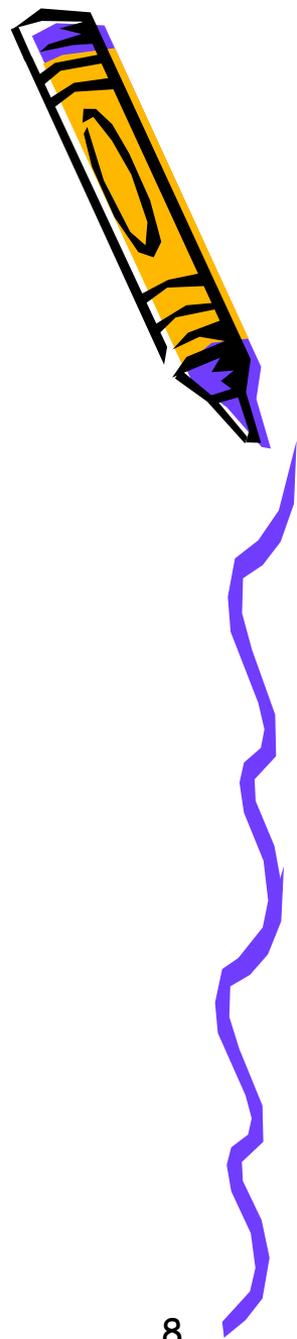
- a. Hay salt (loose)
- b. Salt block

### 4. Toxicity

- a. Cause—Restricted water with salt intake
- b. Symptoms—Staggering gait, blindness, nervous disorder, hypertension



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# Major/Macro Minerals

## Potassium

### 1. Functions

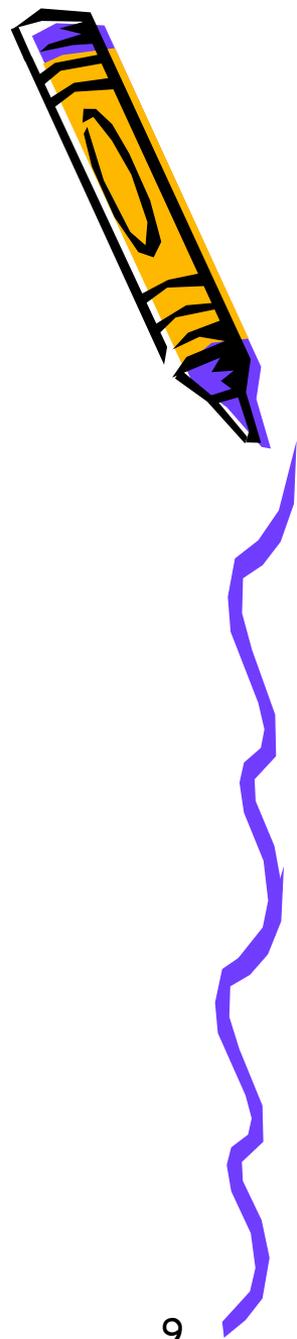
- a. Osmotic pressure
- b. Maintain acid-base balance of body fluids
- c. Muscle activity
- d. Carbohydrate digestion

### 2. Deficiency symptoms

- a. Slow growth rate
- b. Reduced feed consumption
- c. Muscle weakness
- d. Diarrhea



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# Major/Macro Minerals

## Potassium

### 3. Sources

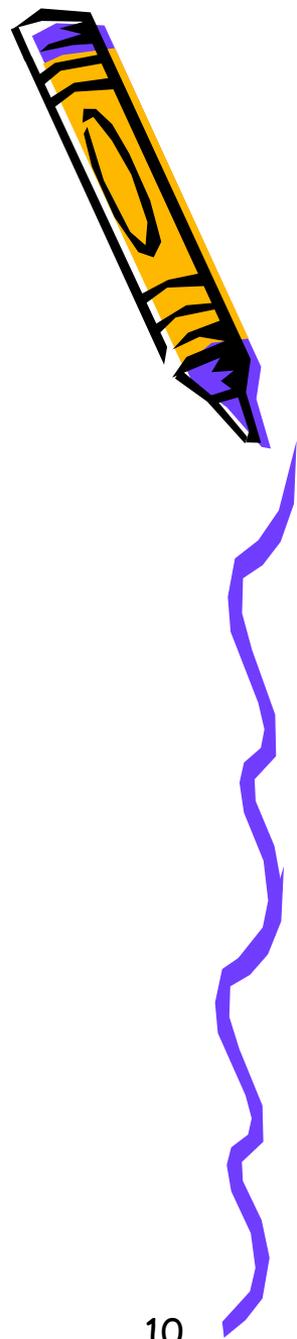
- a. Forages
- b. Grains and concentrates

### 4. Toxicity

- a. Diarrhea
- b. Tremors
- c. Heart failure



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# Major/Macro Minerals

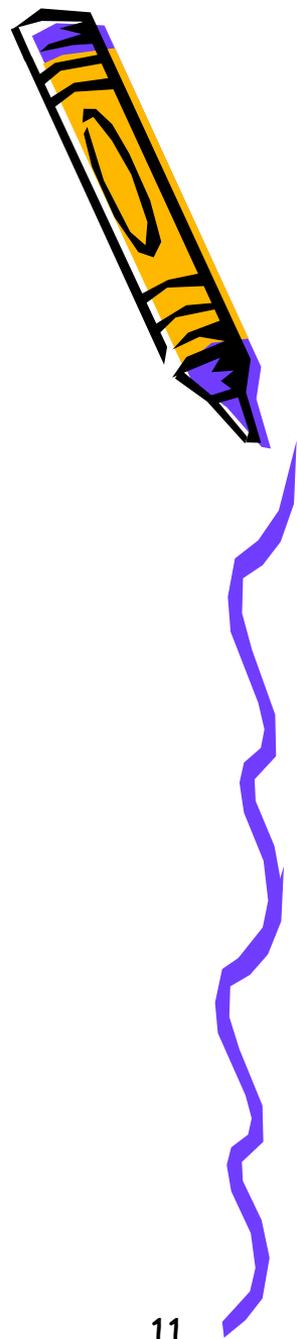
## Magnesium

### 1. Functions

- a. Activate enzyme systems in body
- b. Proper maintenance of nervous system
- c. Carbohydrate digestion
- d. Utilization of zinc, phosphorus and nitrates
- e. Normal skeletal development

### 2. Deficiency symptoms

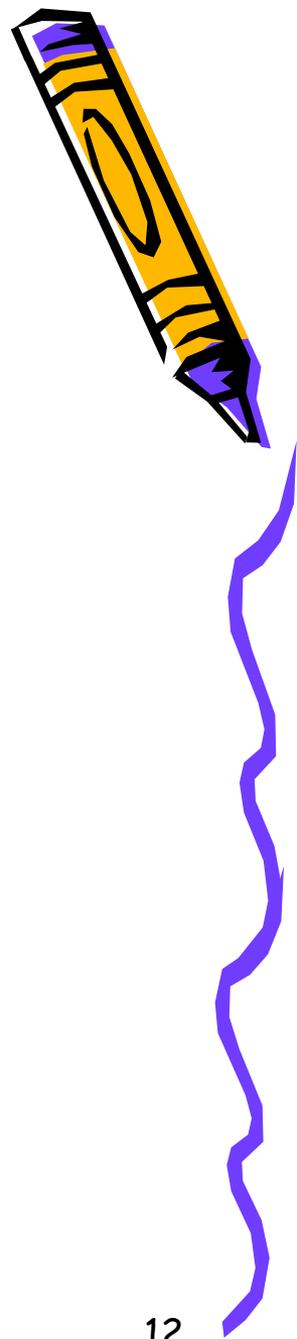
- a. Muscle spasms and convulsions
- b. Hyperirritability



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# Major/Macro Minerals

## Magnesium

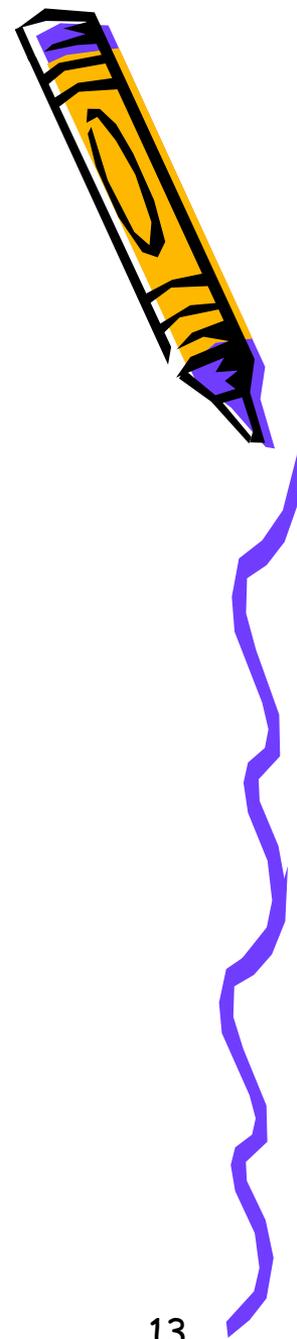


3. Sources
  - a. Most rations contain enough
  - b. Can be mixed with salt or supplement
  - c. If diet is low, magnesium will be pulled from bones



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# Major/Macro Minerals



## Sulfur

### 1. Functions

- a. Amino acids make-up
- b. Lipid metabolism
- c. Carbohydrate metabolism
- d. Energy metabolism

### 2. Deficiency symptoms

- a. Unthriftiness
- b. Slow growth

### 3. Sources

- a. Forages—Especially legumes
- b. Water

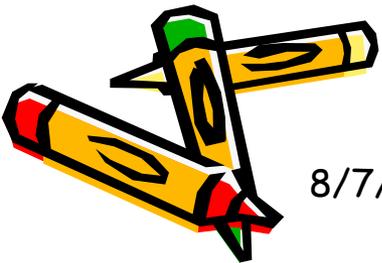
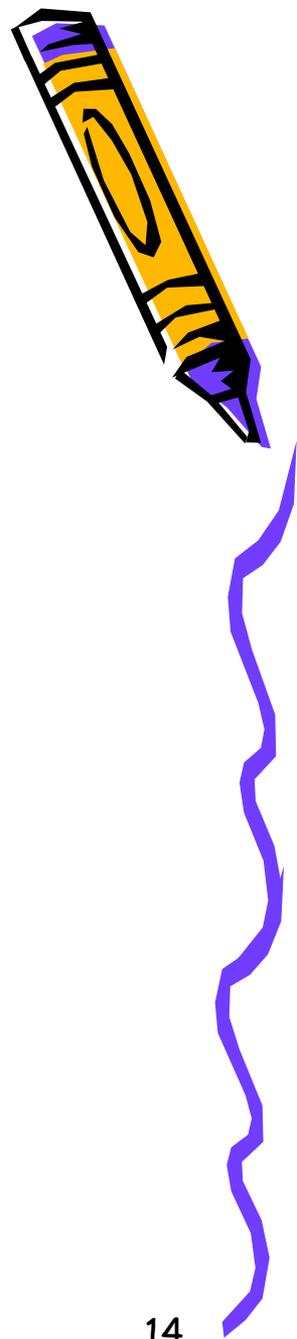


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# Micro Minerals

## Iron

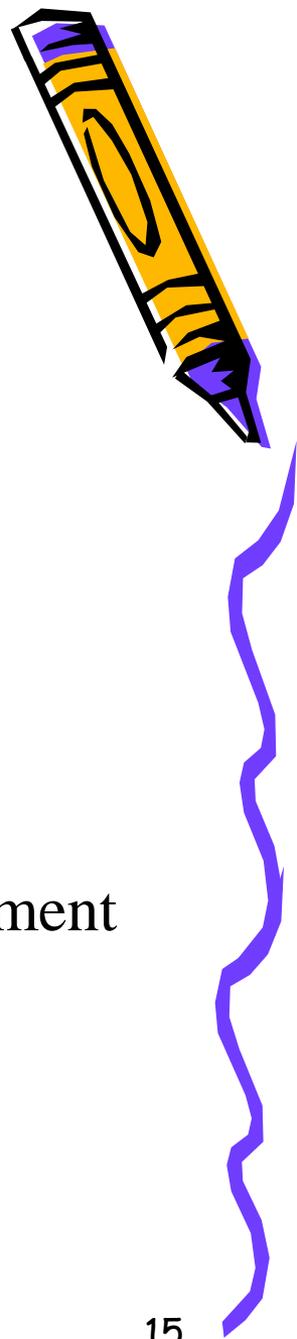
- 1. Functions**
  - a. Hemoglobin formation
  - b. Oxidation of nutrients in cells
  
- 2. Deficiency symptom—Anemia**
  
- 3. Sources**
  - a. Grains
  - b. Forages
  - c. Trace-mineralized salt with iron



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# Micro Minerals

## Manganese



### 1. Functions

- a. Utilization of phosphorus
- b. Assimilation of iron
- c. Reduction of nitrates
- d. Amino acid and cholesterol metabolism
- e. Synthesis of fatty acids

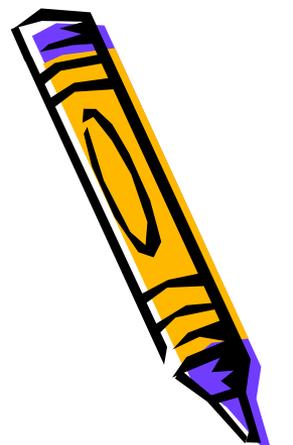
### 2. Deficiency symptoms

- |                                     |                              |
|-------------------------------------|------------------------------|
| a. Swollen and stiff joints         | b. Abnormal bone development |
| c. Sterility                        | d. Delayed estrus            |
| e. Reduced ovulation                | f. Abortion                  |
| g. Deformed, weak or dead offspring |                              |
| h. Appetite loss, slow gain         | i. Rough hair coat           |



# Micro Minerals

## Manganese



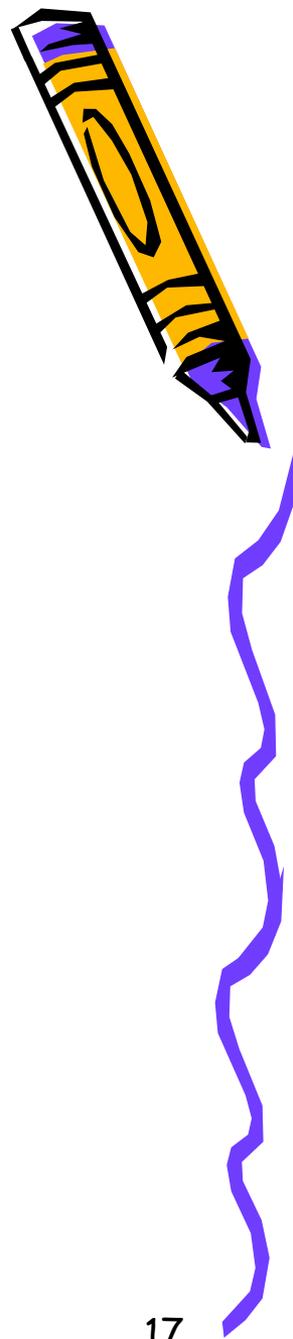
- 3. Sources**
  - a. Trace-mineralized salt
  - b. Most rations are sufficient



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# Micro Minerals

## Copper

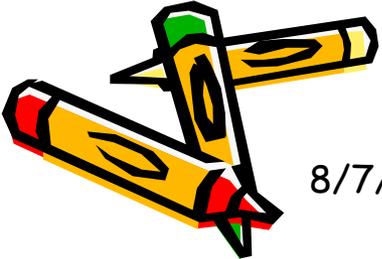


### 1. Functions

- a. Hemoglobin formation
- b. Activate some enzyme systems
- c. Hair development and pigmentation
- d. Wool growth
- e. Bone development
- f. Reproduction
- g. Lactation

### 2. Deficiency symptoms

- a. Severe diarrhea
- b. Slow growth (caused by anemia)
- c. Swelling of joints
- d. Bone abnormalities
- e. Weakness at birth
- f. Breathing difficulty
- g. Lack of muscle coordination
- h. Sudden death

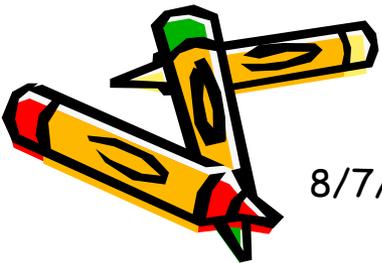
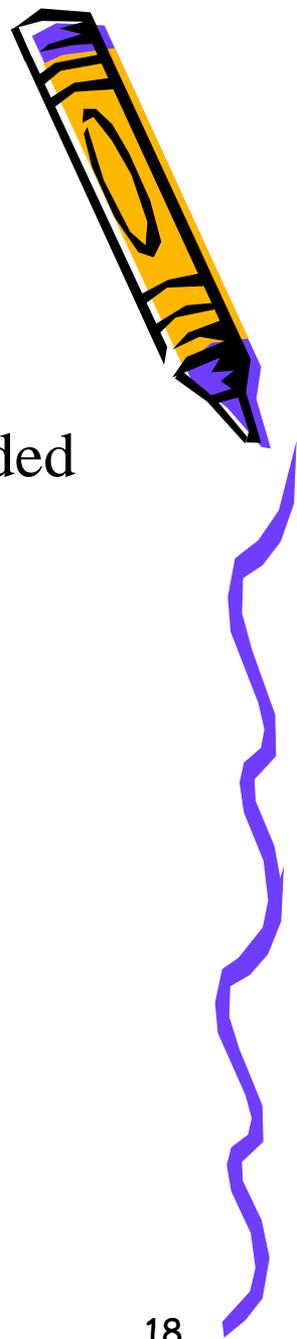


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# Micro Minerals

## Copper

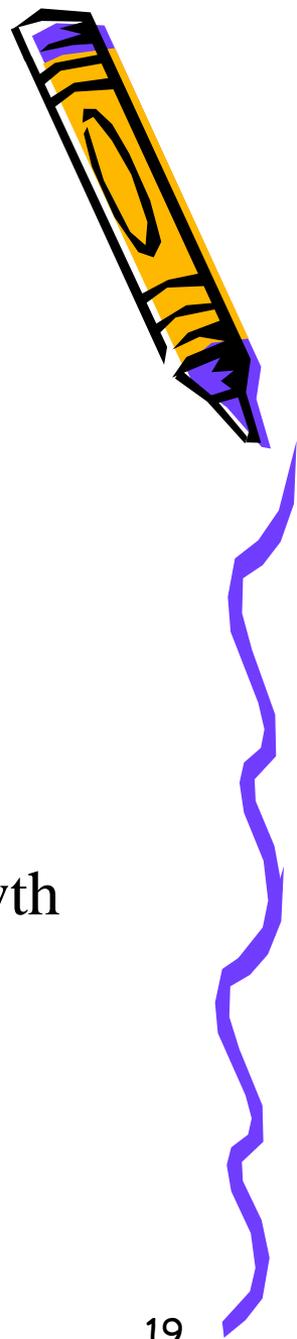
3. **Sources**—Most livestock feeds have more than needed
4. **Toxicity**
  - a. Levels—Above 50 ppm
  - b. Symptoms—Anemia, jaundice



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# Micro Minerals

## Zinc



### 1. Functions

- a. Normal development of skin, hair, wool, bones and eyes
- b. Prevent parakeratosis
- c. Promote healing
- d. Enzyme systems
- e. Protein synthesis
- f. Metabolism
- g. Insulin

### 2. Deficiency symptoms

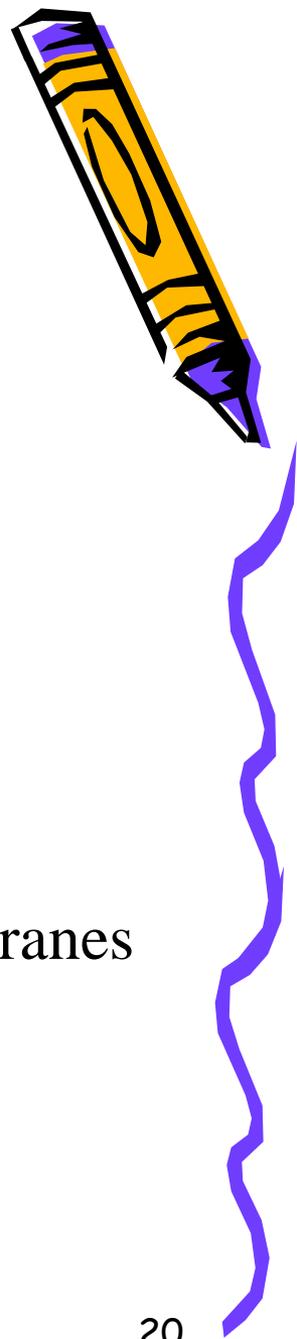
- a. Parakeratosis (rough, thick skin in swine)
- b. Thick skin on neck, muzzle, back of ears (cattle)
- c. Slow wound healing
- d. Poor appetite, slow growth
- e. Swelled hocks and knees, stiff gait
- f. Inflammation of nose and mouth tissues

### 3. Source—Trace-mineralized salt



# Micro Minerals

## Molybdenum



### 1. Functions

a. Enzyme xanthine oxidase

(1) Milk

(2) Body tissues

(3) Uric acid (poultry)

b. Stimulates rumen organisms

2. **Source**—Most normal rations are adequate

### 3. Toxicity

a. Diarrhea

c. Loss of hair color

e. Lameness

g. Osteoporosis

b. Poor growth

d. Bleached mucous membranes

f. Joint abnormalities

h. Death



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# Micro Minerals

## Selenium

### 1. Functions

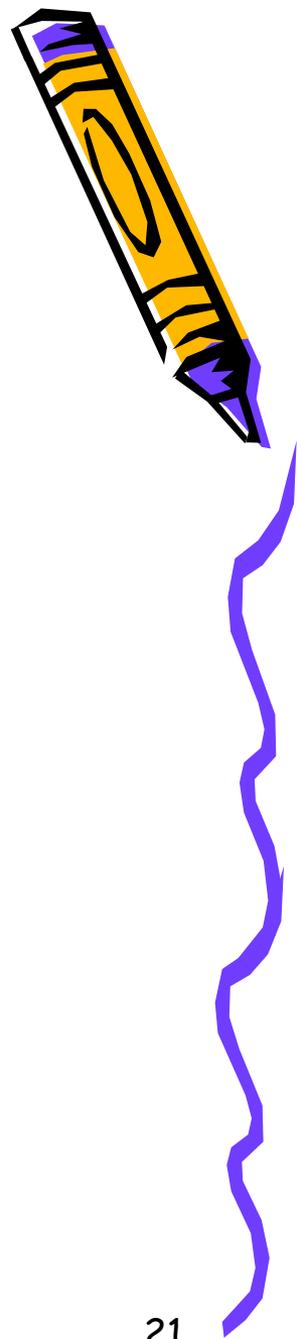
- a. Vitamin E absorption
- b. Part of enzyme glutathione peroxidase

### 2. Deficiency symptoms

- a. White muscle disease
- b. Retained placenta in ruminants
- c. Low fertility in ruminants
- d. Diarrhea

### 3. Sources

- a. Selenium injections
- b. Roughages
- c. Mixed into ration (not authorized by FDA for all animals)



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# Micro Minerals

## Selenium

### 4. Toxicity

a. Acute—Intake of accumulator plants over short period

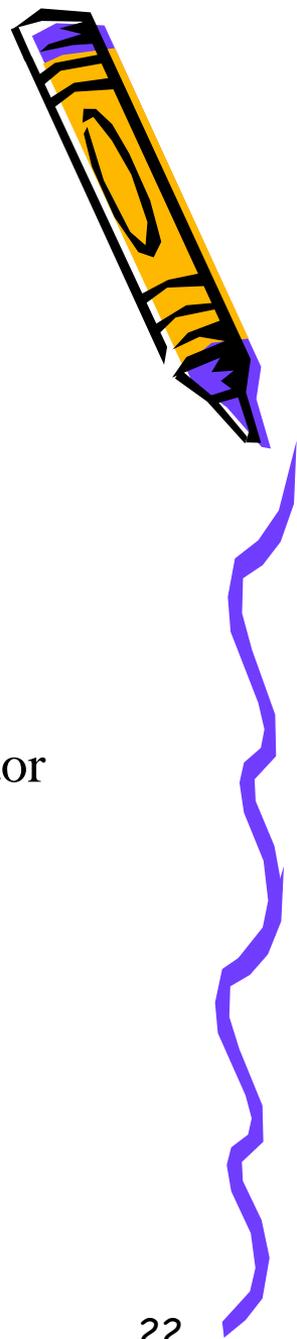
- (1) Labored breathing
- (2) Abnormal movement and posture
- (3) Prostration
- (4) Diarrhea
- (5) Death

b. Chronic—Blind staggers—intake of limited amount of accumulator plants over a longer period of time

- (1) Impaired vision
- (2) Wandering
- (3) Stumbling
- (4) Death



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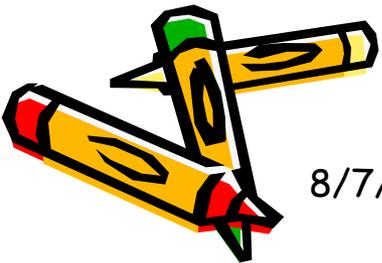


# Micro Minerals

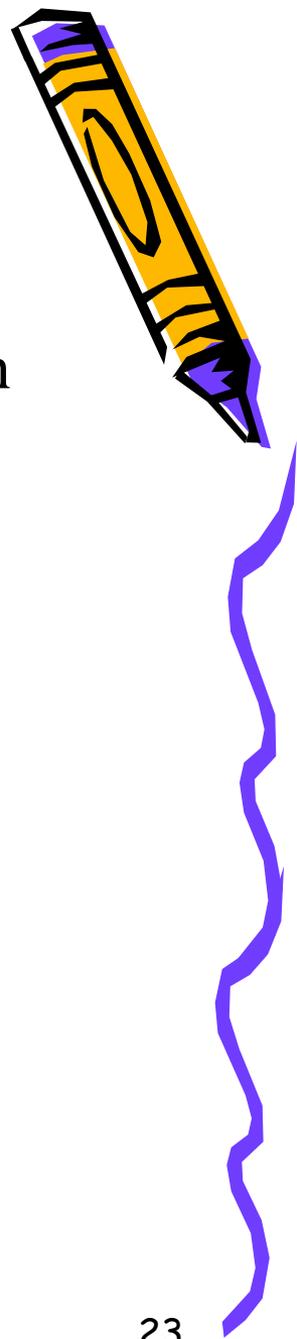
## Selenium

Chronic alkali disease--Intake of grains or grasses with more than 5 mg selenium/K over a long period

- (1) Liver cirrhosis
- (2) Lameness
- (3) Hoof malformations
- (4) Hair loss
- (5) Emaciation



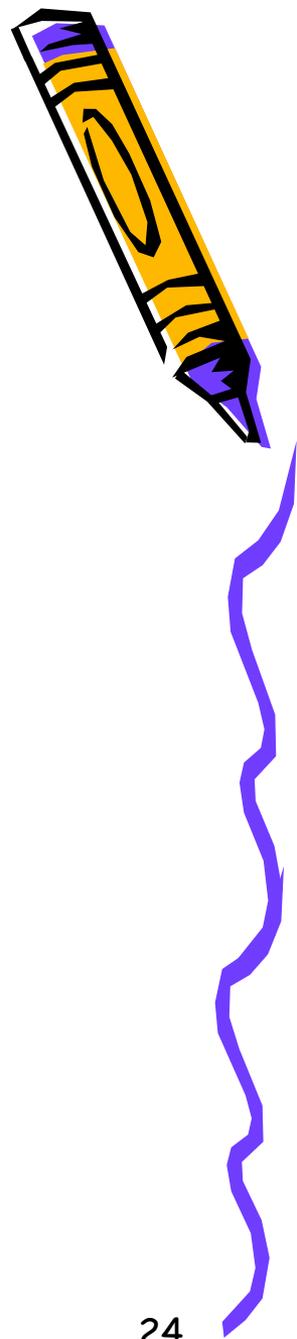
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# Micro Minerals

## Cobalt

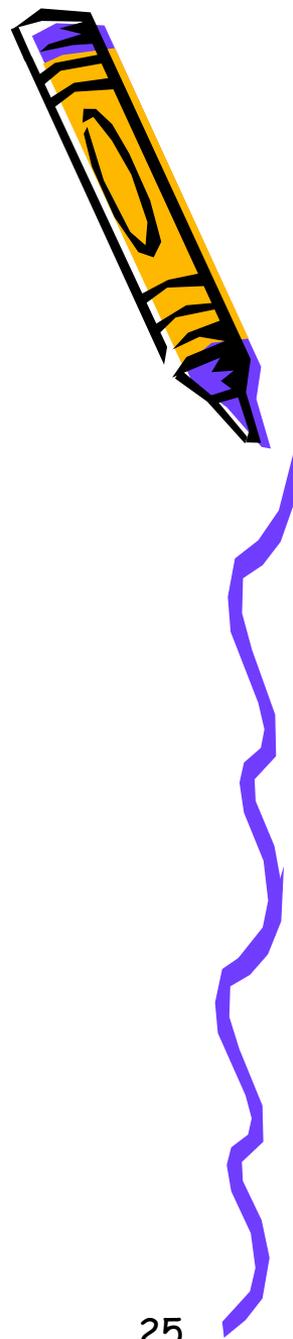
1. **Functions**
  - a. Synthesis of vitamin B12
  - b. Rumen bacteria growth
2. **Deficiency symptoms**
  - a. Poor appetite/general malnutrition
  - b. Weakness
  - c. Anemia
  - d. Slow growth
  - e. Decreased fertility
  - f. Lower wool and milk production
3. **Sources-** supplement



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# Micro Minerals

## Iodine



1. **Function--**Thyroxine production

2. **Deficiency symptoms**

- a. Goiter
- b. Weak or dead offspring
- c. Offspring born without hair
- d. Infected navels at birth

3. **Sources**

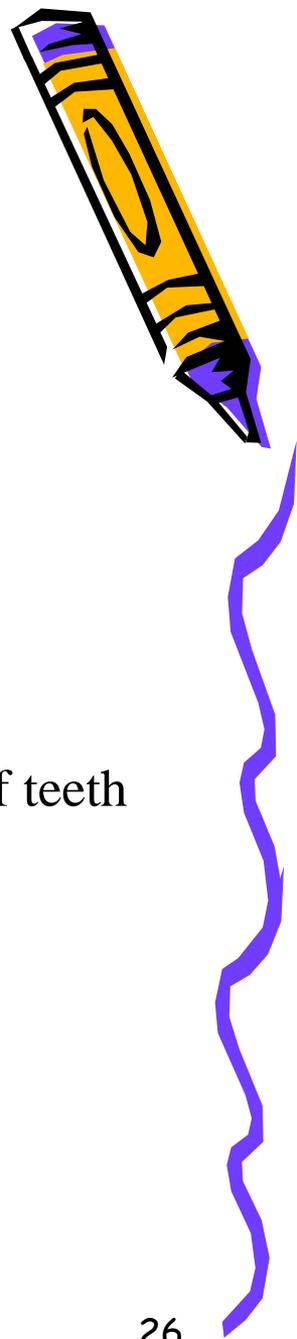
- a. Iodized salt
- b. Ration supplement



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# Micro Minerals

## Fluorine



### 1. Functions

- a. Prevent cavities
- b. Slow down osteoporosis

2. **Deficiency-** is rare; supplementing the ration is not recommended

### 3. Sources

- a. Water
- b. Forages

### 4. Toxicity (an accumulative poison)

- a. Tooth enamel loss
- b. Uneven, excessive wearing of teeth
- c. Bones--thick, soft, weak
- d. Lameness
- e. Poor appetite, poor gains, weight loss
- f. Rough hair coat
- g. Lowered milk production



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