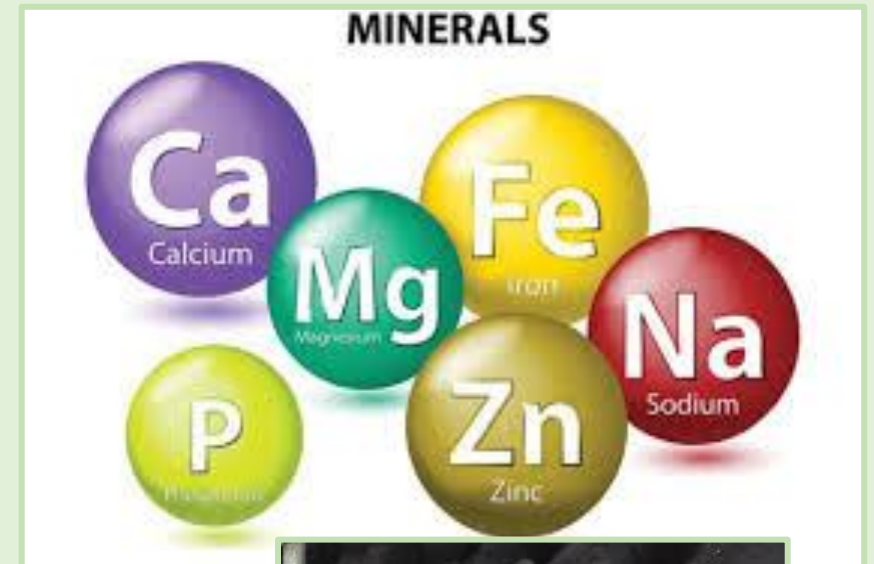


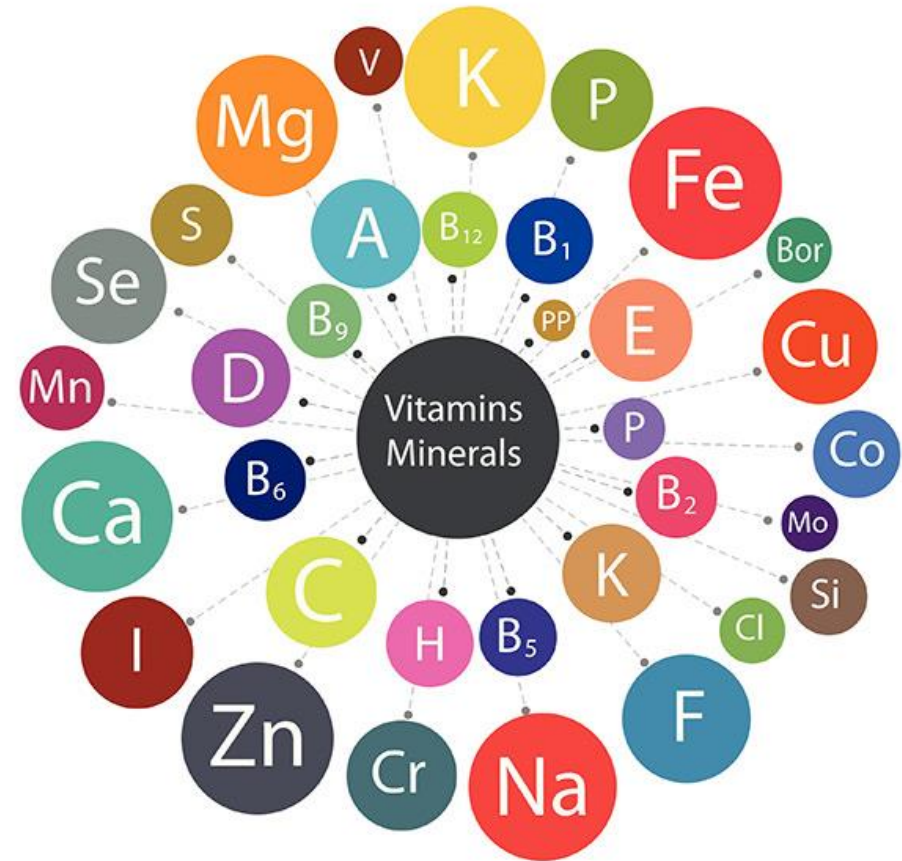
MINERAL AND VITAMIN REQUIREMENT GUIDELINE (Level 1)

Topic	Training & information Content
3.1	Estimating feeding value of fodder & feed on dairy farms
3.2	Sampling feeds & forages/analysis interpretation
3.3	Estimating Dry Matter intake for various breeds/age categories of dairy cattle in the tropics
3.4	Reviewing feed intake, rumen fill, Body Condition Scoring (BCS)
3.5	Life weight estimation of cows
3.6	Rumen fermentation
3.7	Mineral & vitamin requirement, guidelines
3.8	Manure scoring and evaluation
3.9	Guidelines for ration calculations for various breeds, heifers, lactation stage (Rumen8)
3.10	Use of Rumen8 software for ration calculation
3.11	Optimization of ration with Rumen8
3.12	Feeding management guidelines
3.13	Feeding management of dry cows/close-up
3.14	Feeding systems
3.15	Metabolic disorders
3.16	Scoring locomotion and hoof condition
3.17	Mycotoxin in dairy cattle nutrition
3.18	Heat stress in dairy cattle nutrition
3.19	Monitoring feeding management, using KPIs (based on Rumen8)



1. You will learn about (learning objectives):

- Types of minerals and vitamins.
- Functions of minerals and vitamins in a dairy cow.
- Mineral and vitamin requirements by dairy cattle.



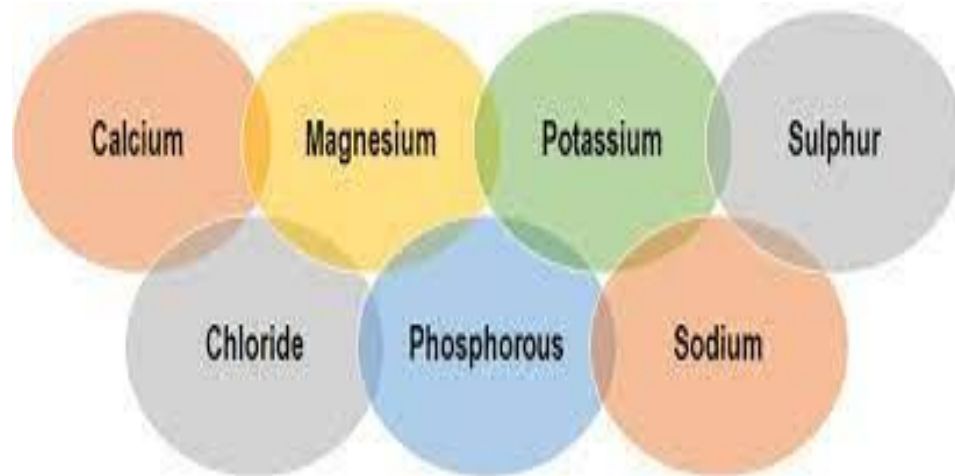
2. Introduction

- **Minerals:** are inorganic elements needed in the cow's body to support some functions.
- Minerals and vitamins are found in feeds that cows eat.
- Vitamins are a source of nutrients needed in small quantities to maintain life and body functions.
- Mineral are divided into two categories;
 - i. Macro minerals,
 - ii. Micro minerals.



3. Macro and Micro minerals

- **Macro minerals:** are minerals that are needed by cows in bigger/larger quantities as compared to microminerals.
- Macro minerals are expressed and measured as a percentage of dry matter intake (DMI).
- Examples of these minerals are;
 - Calcium (Ca), phosphorus (P), magnesium (Mg), potassium (K), Sulphur (S), sodium (Na) and chlorine (Cl).



- **Micro minerals:** are minerals needed in smaller quantities.
- They are added to cows ration as premixes.
- Examples of these trace minerals are;
 - Cobalt (Co), copper (Cu), iron (Fe), iodine (I), manganese (Mn), molybdenum (Mo), selenium (Se), zinc (Zn), nickel (Ni) and chromium (Cr).



6. Macro minerals: Calcium (Ca)

- Majority of calcium in the cow's body is found in animals bones and teeth.
- Forages also contain calcium (legumes contain more Ca than grasses).

Functions of Calcium

- Important for bone & teeth formation, development and maintenance.
- Needed for milk production.
- Important for blood clotting.
- Supports muscle contraction.



7. Phosphorus (P)

- Majority of phosphorus can be found in bones and teeth.
- Concentrates are higher in phosphorus than forages. Forage phosphorus levels are lower in mature forages and during dry spells.

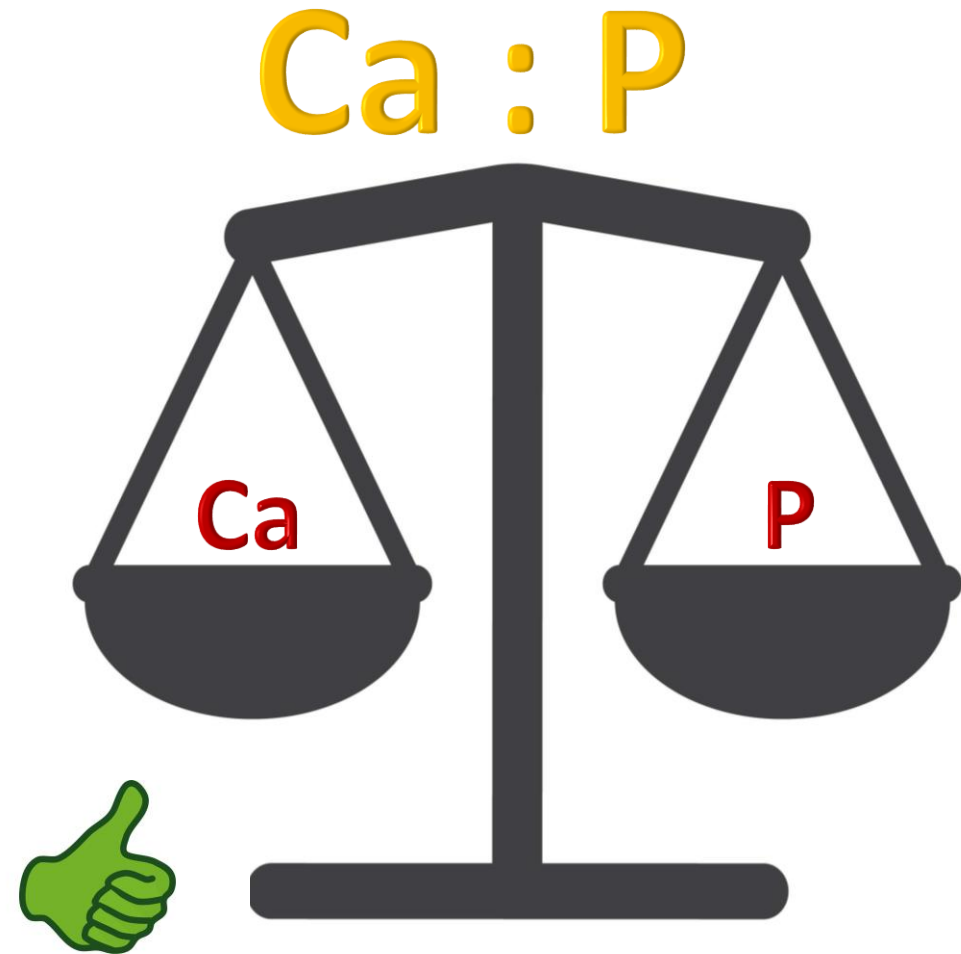
Signs of Phosphorus deficiency

- Decreased appetite (DMI) and growth.
- Reduced milk production.
- Cows eating soil, rocks, wooden post or bones.



8. Calcium (Ca) and Phosphorus (P) proportion

- Ca and P are one of the major minerals and should be balanced for best utilization by cow.
- Interactions between calcium and phosphorus affects required level of each other in rations.
- An imbalance of the calcium and phosphorus ration can impact fertility.



9. Magnesium (Mg)

- Majority of magnesium is found in bones of cows.
- Mg is found in feeds, with plant protein sources having higher Mg content.

Signs of Magnesium deficiency

- Frothing at the mouth.
- Muscle tremors (grass tetany) - See module metabolic disorders.
- Increased blood flow.



PERIODIC TABLE

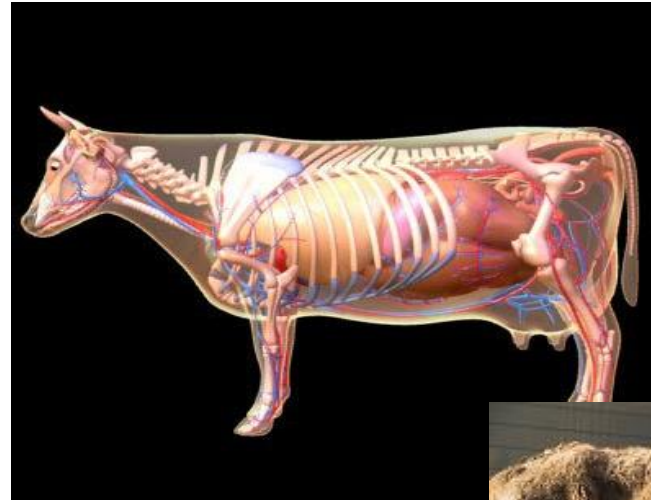
1 H Hydrogen	2 He Helium																	18 Ar Argon	19 K Potassium	20 Ca Calcium	21 Sc Scandium	22 Ti Titanium	23 V Vanadium	24 Cr Chromium	25 Mn Manganese	26 Fe Iron	27 Co Cobalt	28 Ni Nickel	29 Cu Copper	30 Zn Zinc	31 Ga Gallium	32 Ge Germanium	33 As Arsenic	34 Se Selenium	35 Br Bromine	36 Kr Krypton														
3 Li Lithium	4 Be Beryllium																	10 Ne Neon	11 Na Sodium	12 Mg Magnesium	13 Al Aluminum	14 Si Silicon	15 P Phosphorus	16 S Sulfur	17 Cl Chlorine	18 Ar Argon	37 Rb Rubidium	38 Sr Strontium	39 Y Yttrium	40 Zr Zirconium	41 Nb Niobium	42 Mo Molybdenum	43 Tc Technetium	44 Ru Ruthenium	45 Rh Rhodium	46 Pd Palladium	47 Ag Silver	48 Cd Cadmium	49 In Indium	50 Sn Tin	51 Sb Antimony	52 Te Tellurium	53 I Iodine	54 Xe Xenon						
55 Cs Cesium	56 Ba Barium																	86 Rn Radon	87 Fr Francium	88 Ra Radium	89 Ac Actinium	90 Th Thorium	91 Pa Protactinium	92 U Uranium	93 Np Neptunium	94 Pu Plutonium	95 Am Americium	96 Cm Curium	97 Bk Berkelium	98 Cf Californium	99 Es Einsteinium	100 Fm Fermium	101 Md Mendelevium	102 No Nobelium	103 Lr Lawrencium	104 Rf Rutherfordium	105 Db Dubnium	106 Sg Seaborgium	107 Bh Bohrium	108 Hs Hassium	109 Mt Meitnerium	110 Ds Darmstadtium	111 Rg Roentgenium	112 Cn Copernicium	113 Nh Nihonium	114 Fl Flerovium	115 Mc Moscovium	116 Lv Livermorium	117 Ts Tennessine	118 Og Oganesson

10. Potassium (K)

- Forages are a good source of potassium especially well growing green pastures.

Signs of Potassium deficiency

- Reduced feed and water intake.
- Low milk production.
- Reduced weight gain.
- Rough haircoat.
- Muscle weakness.



Source:

https://www.google.com/search?q=potassium+deficiency+in+cattle&rlz=1C5CHFA_enKE951KE951&sxsrf=APq-WBunNhtxda4Z00MueQwl2mYVtVR9PA:1648058511163&source=Inms&tbm=isch&sa=X&ved=2ahUKEwi1x4Gx6Nz2AhWDhv0HHZk8AqkQ_AUoAXoECAEQAw

11. Sodium (Na) and Chlorine (Cl)

- Cows consume more salt when offered free choice.
- Sodium deficiency is common and not chlorine.
Sodium deficiency may lead to;
 - Decreased appetite.
 - Abnormal eating habits.
 - Low dry matter intake (DMI).
 - Cows licking soil and wood (pica).

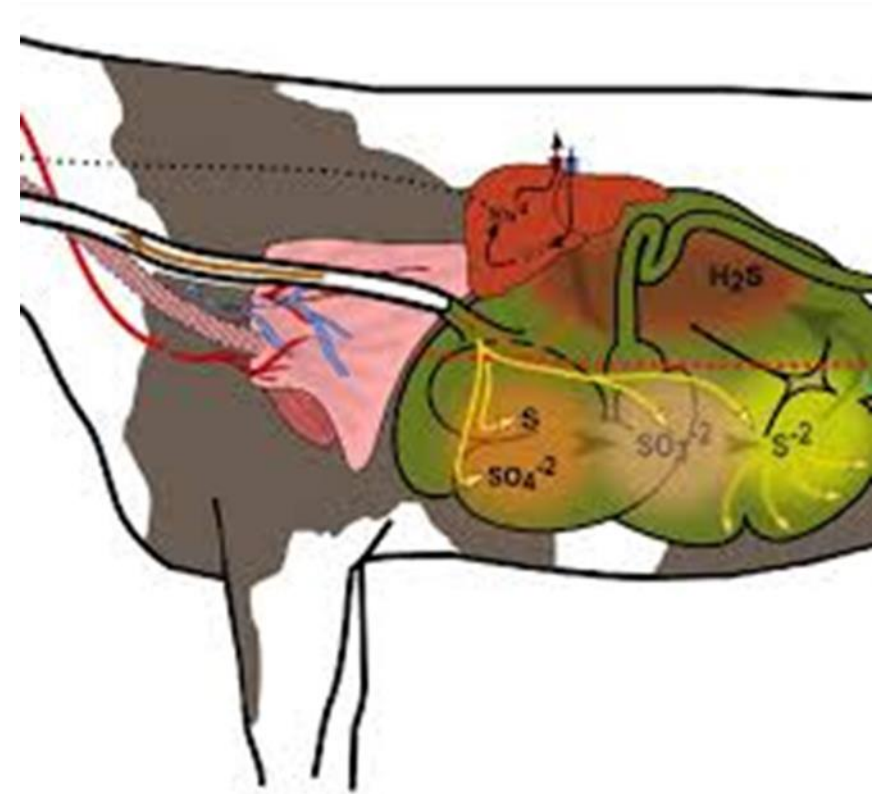


12. Sulphur (S)

- Sulphur is a building block for various amino acids and vitamin B (thiamin & biotin) and assists in acid-base balance.
- Sulphur in feedstuff is largely found as a component of protein.

Signs of high Sulphur levels/Sulphur toxicity

- Diarrhea in cows.
- Restlessness and difficulty in breathing.
- Muscle twitching.



19. Guidelines for feeding macro minerals

Mineral	Lactating cows	Dry cows	Growing calves	Maximum tolerable level
Calcium, %	0.31	0.18	0.58	-
Magnesium, %	0.10	0.12	0.20	0.40
Phosphorus, %	0.21	0.16	0.26	-
Potassium, %	0.60	0.60	0.70	3.0
Sodium, %	0.07	0.07	0.10	-
Sulphur, %	0.15	0.15	0.15	0.40

NRC, 1996. Adapted from NRC. Nutrient Requirements of Beef Cattle, Sixth Edition

20. Factors affecting mineral intake

- Mineral availability and content.
- Palatability and form of the mineral product.
- Mineral feeder location. Place mineral blocks or mineral lick near watering points to increase consumption.
- Deficiency of other nutrients in the diet.
- Forage quality and other feed supplements.
- Concentration of other minerals.



21. Vitamins

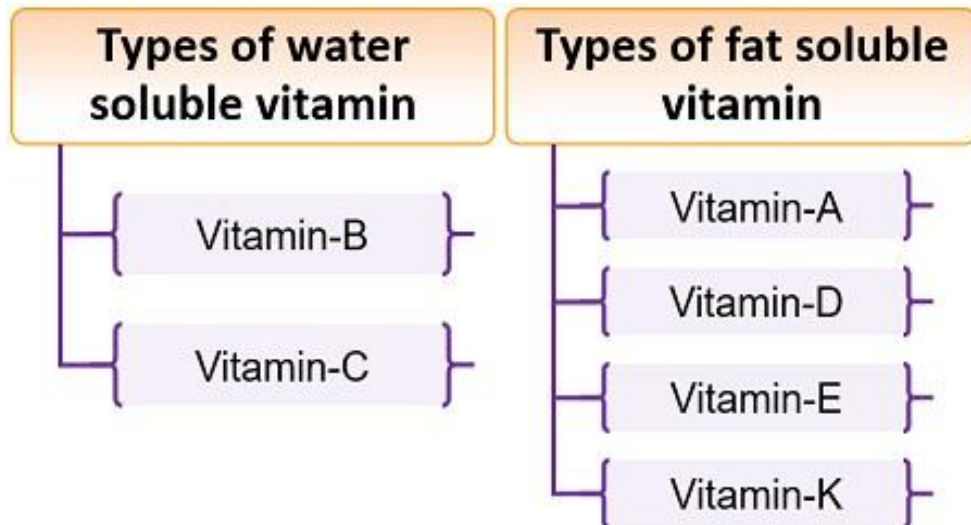
- Vitamins are important for normal functioning of the cow's body.
- Different types of minerals works towards sustaining various operations of the body.
- Colostrum contains vitamins and is a source of vitamins to newborn calves.
- Most vitamins are bound to specific proteins.
- Young calves obtain soluble-vitamins directly added to their diets.



Colostrum is a source of vitamins to newborn calves

22. Types of Vitamins

- There are various classes of vitamins namely;
 - i. Water-soluble vitamins,
 - ii. Fat-soluble vitamins.



i. Water soluble vitamins

- These vitamins include;
 - Vitamin B complex, vitamin C
- They are provided by rumen microbes. Rumen microbes synthesize water-soluble vitamins to meet her nutritional requirement.



22.1 Types of Vitamins Cont'd...

ii. Fat soluble vitamins

- High levels of fat can improve absorption of these vitamins.
- These vitamins include;
 - Vitamin A, D, E and K.



Types of fat soluble vitamin

Vitamin-A

Vitamin-D

Vitamin-E

Vitamin-K