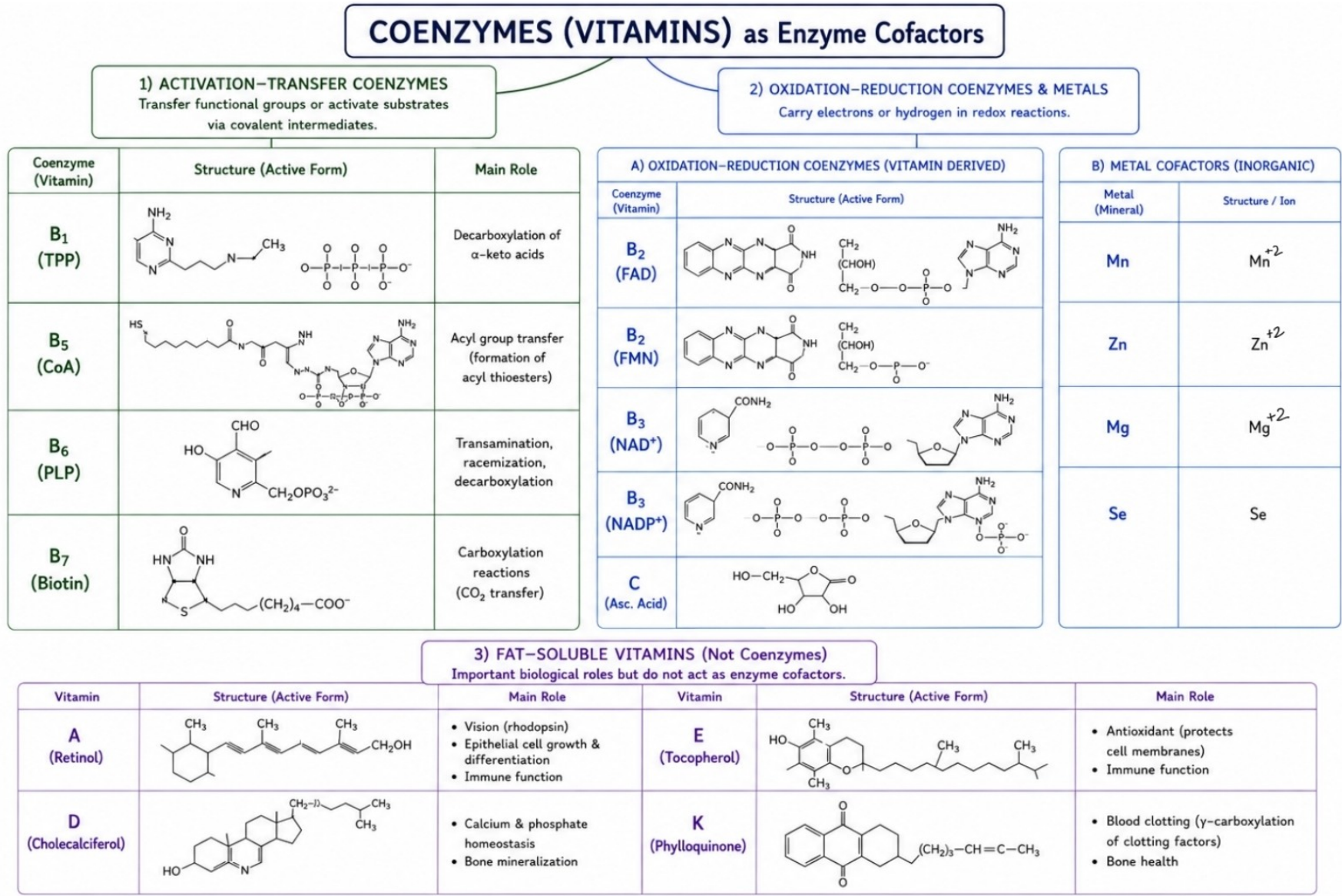
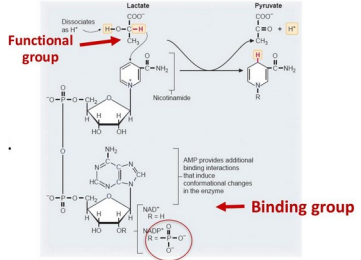
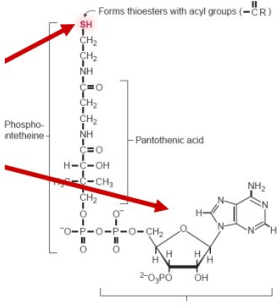
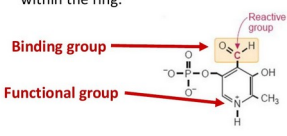
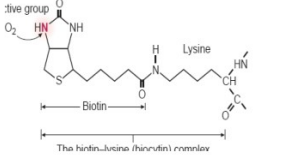
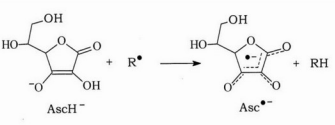


VITAMINS & COFACTORS



B3 (niacin)	NAD ⁺	-Dehydrogenation: oxidation of alcohols & aldehydes NAD ⁺ → NADH NADPH → NADP ⁺ -The difference between them is in the phosphate molecule of the binding group, which means difference in the enzymes they bind to.	-Lactate dehydrogenase -Happens in catabolism rxns.(breaking up molecules, oxidation rxns)	Cosubstrate; binds non-covalently to enzyme ; ADP portion binds tightly to enzyme	C opposite ring in nicotinamide accepts hydride (H ⁻)	
	NADP ⁺		-Various dehydrogenases -Anabolic rxns(building up molecules)	Cosubstrate; non-covalent; extra phosphate influences enzyme specificity	Same nicotinamide functional carbon	
B5 (pantothenate) which is made of β-alanine and pantoic acid	Coenzyme A (CoA)	-Attacks carbonyl groups; forms acyl thioesters conjugated CoA molecule is energy-rich	Pyruvate dehydrogenase citrate synthase	Adenosine 3',5'-bisphosphate nucleotide; tight & reversible binding	Sulfhydryl (-SH) (nucleophile)	
B6 (pyridoxal/pyridoxamine/pyridoxine)	Pyridoxal phosphate (PLP)	-Reversible transamination transfers amino groups between amino acids and keto acids.	Transaminases	Functional/binding groups are within the PLP ring	Aldehyde	
B7 (biotin)	Biotin	-Carboxylation -Deficiencies are rare.However if they were present they conclude prolonged intake of antibiotics and excessive raw egg eating (avidin)	Pyruvate carboxylase acetyl-CoA carboxylase	Covalently bound to enzyme through a lysine residue in active site	Reactive biotin participates in CO ₂ /carboxylation chemistry	
Vitamin C	Ascorbic acid / ascorbate	-Antioxidant (gives electron to. A substrate making the coenzyme a stable radical through resonance,rotation.) -Hydroxylation(hydroxyproline) -Reducing the effect of inflammatory molecules	Prolyl hydroxylase → 4-hydroxyproline in collagen	-----	-----	

Vitamin precursor	Coenzyme	Enzyme binding	example
Metal cofactor	Zn ²⁺	May be covalently bound in metalloproteins or non-covalently associated (metal associated)	-Carbonic anhydrase(zinc finger) -carboxypeptidase - Zinc can stabilize negative oxygen charge in alcohol dehydrogenase doesn't participate in the rxn but facilitates it.
	Mg ²⁺	Binding phosphate groups; helps anchor TPP and stabilizes it	Hexokinase ,TPP
	Se	-----	Glutathione peroxidase
	Mn ²⁺	-----	Superoxide dismutase

Quiz time, Good luck👍

Q1. Which functional/reactive group of Thiamin Pyrophosphate (TPP) is directly responsible for binding the substrate and releasing CO₂ during decarboxylation reactions?

- A. Sulfhydryl (–SH) group
- B. Reactive thiamin carbon
- C. Aldehyde group
- D. Flavin ring nitrogen

Answer: B. Reactive thiamin carbon

Q2. TPP is anchored to enzymes such as pyruvate dehydrogenase and α-ketoglutarate dehydrogenase through the assistance of which divalent cation?

- A. Zn²⁺
- B. Mn²⁺
- C. Mg²⁺
- D. Fe²⁺

Answer: C. Mg²⁺

Q3. FAD (Flavin Adenine Dinucleotide) is unique among coenzymes because it is typically:

- A. A loosely associated cosubstrate
- B. Covalently bound as a prosthetic group of flavoproteins
- C. Bound only through ionic interactions
- D. Released after every reaction cycle

Answer: B. Covalently bound as a prosthetic group of flavoproteins

Q4. What is the key structural difference between NAD⁺ and NADP⁺ that determines the specific enzymes each coenzyme binds to?

- A. Number of nicotinamide rings
- B. Presence of a flavin ring
- C. An additional phosphate group on the binding molecule
- D. Type of nitrogenous base attached

Answer: C. An additional phosphate group on the binding molecule

Q5. During oxidation-reduction reactions, NAD⁺ is converted to NADH by accepting which chemical species?

- A. A proton (H⁺)
- B. A hydroxyl ion (OH[−])
- C. A hydride ion (H[−])
- D. An electron pair only

Answer: C. A hydride ion (H^-)

Q6. Coenzyme A (derived from Vitamin B5/pantothenate) uses which reactive functional group to attack carbonyl groups and form acyl thioesters?

- A. Aldehyde group
- B. Sulfhydryl ($-SH$) group
- C. Carboxyl group
- D. Amino group

Answer: B. Sulfhydryl ($-SH$) group

Q7. Pyridoxal Phosphate (PLP), the active form of Vitamin B6, primarily facilitates which biochemical process?

- A. Carboxylation of pyruvate
- B. Reversible transamination between amino acids and keto acids
- C. Hydride transfer in redox reactions
- D. Hydroxylation of proline

Answer: B. Reversible transamination between amino acids and keto acids

Q8. Biotin (Vitamin B7) is covalently attached to the active site of carboxylase enzymes, such as pyruvate carboxylase, through which amino acid residue?

- A. Cysteine residue
- B. Serine residue
- C. Lysine residue
- D. Histidine residue

Answer: C. Lysine residue

Q9. Vitamin C (Ascorbic acid) acts as a coenzyme for prolyl hydroxylase, enabling the hydroxylation reaction required for the formation of which molecule?

- A. Elastin
- B. 4-hydroxyproline in collagen
- C. Hemoglobin
- D. Keratin sulfate

Answer: B. 4-hydroxyproline in collagen

Q10. In carbonic anhydrase and alcohol dehydrogenase, the metal cofactor Zn^{2+} primarily functions by:

- A. Directly participating in electron transfer
- B. Stabilizing charge and facilitating the reaction without participating in it
- C. Acting as a hydride acceptor
- D. Forming a covalent bond with substrate carbon

Answer: B. Stabilizing charge and facilitating the reaction without participating in it

اللَّهُمَّ إِنَّا نَسْأَلُكَ الْجَنَّةَ
وَمَا قَرَّبَ إِلَيْهَا مِنْ قَوْلٍ وَعَمَلٍ
وَنَعُوذُ بِكَ مِنَ النَّارِ
وَمَا يُقَرِّبُ إِلَيْهَا مِنْ قَوْلٍ وَعَمَلٍ