**NAME:** OLAITAN OLANREWAJU

**DEPARTMENT:** PHARMACOLOGY

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**QUESTION:** 1a what are coenzymes

b. Differentiate between fat and water soluble vitamins.

c. Describe niacin in relation to its coenzymatic function.

1a. Coenzymes are any of a number of freely diffusing organic [compounds](https://www.merriam-webster.com/dictionary/compounds) that function as [cofactor](https://www.britannica.com/science/cofactor)s (a cofactor is a non-protein chemical compound or metallic ion that is required for an enzyme's activity as a catalyst, a substance that increases the rate of a chemical reaction.) with [enzyme](https://www.britannica.com/science/enzyme)s in promoting a variety of metabolic reactions. Coenzymes participate in enzyme-mediated [catalysis](https://www.britannica.com/science/catalysis) in stoichiometric ([mole](https://www.britannica.com/science/mole-chemistry)-for-mole) amounts, which are modified during the reaction, and may require another enzyme-catalyzed reaction to restore them to their original state. Examples include nicotinamide adenine dinucleotide (NAD), which accepts hydrogen (and gives it up in another reaction), and [ATP](https://www.britannica.com/science/adenosine-triphosphate), which gives up phosphate groups while transferring [chemical energy](https://www.britannica.com/science/chemical-energy) and reacquires phosphate in another reaction. Most of the B vitamins are coenzymes and are essential in [facilitating](https://www.merriam-webster.com/dictionary/facilitating) the transfer of atoms or groups of atoms between molecules in the formation of carbohydrates, fats, and proteins.

b.

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| Fat soluble vitamins  | Water soluble vitamins  |
| They are soluble in fat  | They are soluble in water. |
| Absorption occurs with lipids and they require bile salt | Absorption is simple.  |
| Carrier proteins are present.  | Absence of carrier proteins  |
| They are stored in the liver.  | They have no storage. |
| Deficiency only manifest when stores are depleted.  | Deficiency manifest rapidly as there is no storage.  |
| Hypervitaminosis. There is possibility of toxicity.  | Toxicity is unlikely since excess is excreted.  |
| The treatment of deficiency involves single large doses.  | Regular dietary supply is required. |
| They include vitamins A, D, E and K | They include vitamins B complexes and C |

c. The active forms of niacin catalyze oxidation-reduction reaction in oxidative pathways. Niacin, has an essential role in controlling energy and metabolic pathways. As a precursor of NAD+ and NADP+, the most important donor and acceptor cofactors in the vast majority of redox reactions occurring in living beings, niacin not only directly regulates metabolism, it promotes direct cross-talk between these environmental and energetic fluctuations and regulates epigenetics, gene expression, and genome stability. In turn, this NAD+-dependent signaling affects the stress response, glucose and lipid metabolism, and inflammation, among other processes. Two families of enzymes, sirtuins and poly-adenosine diphosphate-ribosyltransferases (PARPs), regulate this NAD+-dependent signaling through the catalysis of posttranslational modifications of a wide variety of proteins. These establish a regulatory network that ensures efficient adaptation to energy- and metabolism-compromising conditions.