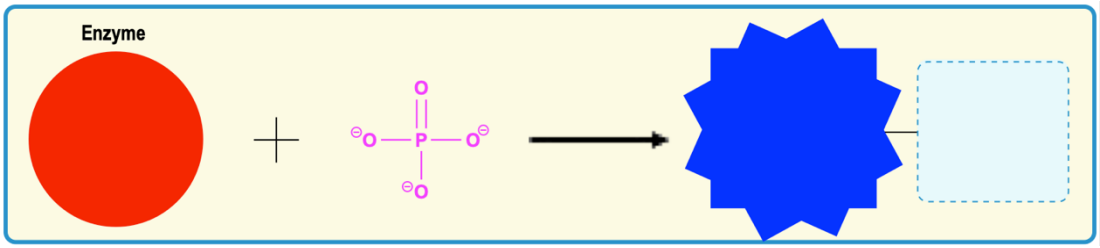
CONCEPT: PHOSPHORYLATION

●*Phosphorylation*: the covalent attachment of _____ groups.

□ This is one of the most common & important forms of enzyme regulation.



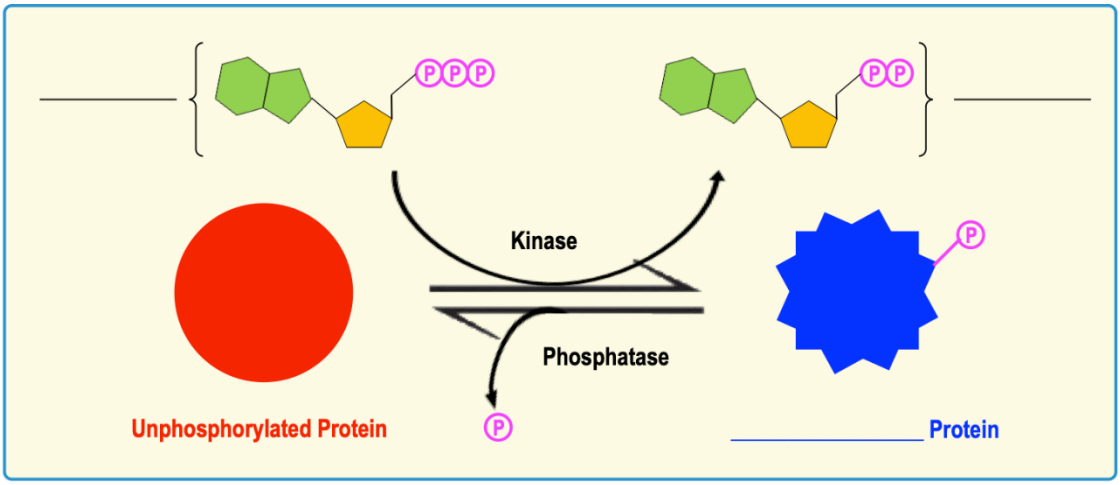
ATP is a Common Source of Phosphorylation

●Adenosine triphosphate (_____) molecules are typically the *source* of the phosphate groups.

□ _____: enzymes that catalyze phosphorylation reactions.

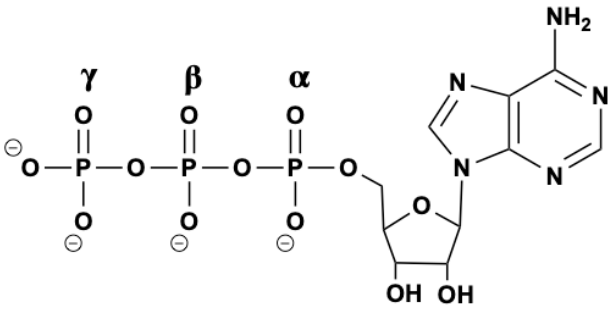
□ _____: enzymes that catalyze the opposite reaction that _____ phosphate groups.

EXAMPLE:



PRACTICE: During kinase phosphorylation, which phosphate group is removed from ATP in the figure below?

a) α
b) β
c) γ
d) α and β
e) β and γ



CONCEPT: PHOSPHORYLATION

Amino Acid Phosphorylation

●Some *amino acids* can be phosphorylated to make _____.

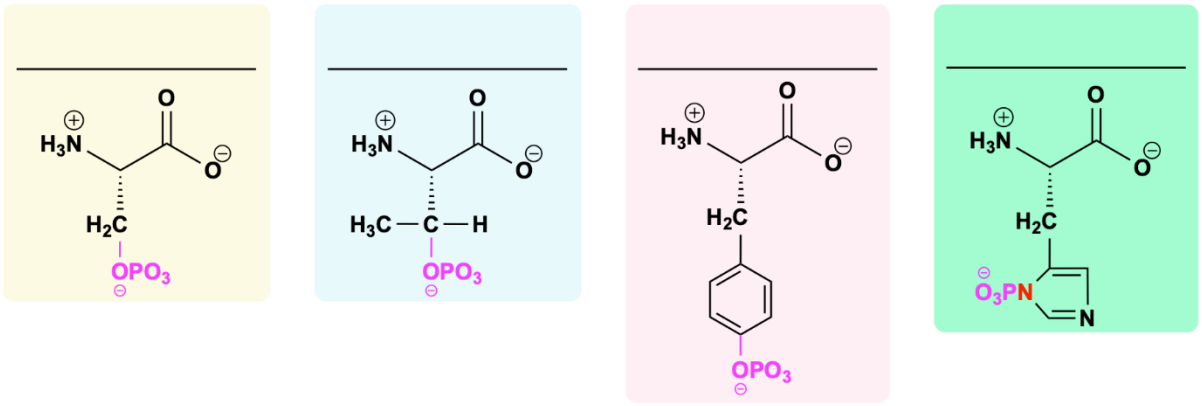
□ Hydroxyl groups on _____, _____ & _____ can be *replaced* with phosphate groups.

□ _____ can also be phosphorylated.

●Phosphorylation makes Ser, Thr, Tyr & His even _____ polar & can lead to changes in enzyme *conformations/states*.

□ Phosphate groups have an overall _____ charge & allow for stronger _____ bonding.

EXAMPLE: Amino Acid Phosphorylation.



PRACTICE: Covalent modification of an enzyme usually involves phosphorylation / dephosphorylation of:

a) Lysine residue.
b) Proline residue.
c) Serine residue.
d) Aspartate residue.

PRACTICE: When the active site of an enzyme is phosphorylated on one of its catalytic amino acid residues, the overall _____ charge of phosphate groups would _____ the affinity for a polar, negatively charged substrate.

a) positive; lower.
b) negative; lower.
c) negative; increase.
d) positive; increase.
e) positive; not change.
f) neutral; not change.