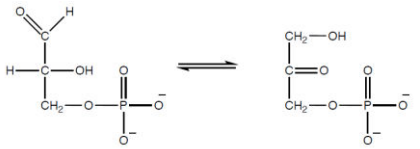
**Tutorial (MBT3004)**

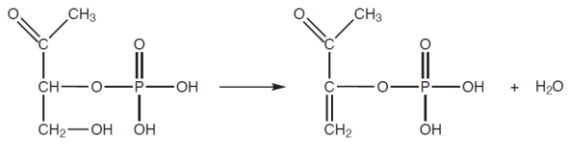
**Q1.** *Triose phosphate isomerase* (TIM) catalyzes the isomerization of glyceraldehyde 3-phosphate to dihydroxyacetone phosphate:




The $K_M$ of TIM for its substrate glyceraldehyde 3-phosphate is 3.2 x $10^{-5}$ M. When [glyceraldehyde 3-phosphate] = 24 μM, the rate of the reaction, $v_o$, is 73.3 μmol/(mL•s).

a. What class of enzyme is TIM?
b. What is $V_{max}$ for this enzyme?
c. Assuming the TIM concentration in this experiment was 3 nmol/mL, what is $k_{cat}$ for this enzyme?
d. What is the catalytic efficiency ($k_{cat}/K_M$) for triose phosphate isomerase?
e. Does the value of $k_{cat}/K_M$ reveal that trisose phosphate isomerase approaches "catalytic perfection"?
f. What determines the ultimate speed limit of an enzyme-catalyzed reaction? That is, what is it that imposes the physical limit on catalytic perfection?

**Q2:** The glycolytic enzyme *enolase* catalyzes the conversion of 2-phosphoglycerate to phosphoenol pyruvate::




The turnover number for enolase is 950/s. The $K_M$ of enolase for the substrate 2-phosphoglycerate is 8 μM.

a. What class of enzyme is enolase?
b. In an experiment using 1.32 nM enolase, what is $V_{max}$?
c. The cellular concentration of 2-phosphoglycerate is 47.5 μM. What is $v_o$ under these conditions?
d. What is the catalytic efficiency of enolase?
e. Does enolase approach "catalytic perfection"?