GATE XL (Biochemistry)

Regulation and Inhibition of Enzymes

1. Multiple Choice Question (MCQ)

Which of the following is an example of **allosteric regulation** of an enzyme?
A) Competitive inhibition of hexokinase by glucose-6-phosphate
B) Activation of pyruvate dehydrogenase by ATP
C) Feedback inhibition of aspartate transcarbamoylase by CTP
D) Non-competitive inhibition of succinate dehydrogenase by malonate

Answer: C) Feedback inhibition of aspartate transcarbamoylase by CTP

---

2. Numerical Answer Type (NAT)

An enzyme follows Michaelis-Menten kinetics and has a **Km of 5 mM** and a **Vmax of 200 µmol/min**. In the presence of a **competitive inhibitor**, the apparent Km increases to **10 mM**, while Vmax remains unchanged. Determine the inhibitor's **inhibition constant (Ki)** if the inhibitor concentration is **5 mM**.
(**Use the equation:** Ki = [I] / ((Km' / Km) - 1))

Answer: Ki = 5 mM / ((10 / 5) - 1) = 5 mM / 1 = **5 mM**

---

3. Multiple Choice Question (MCQ)

Which type of enzyme inhibition **cannot** be overcome by increasing the substrate concentration?
A) Competitive inhibition
B) Non-competitive inhibition
C) Uncompetitive inhibition
D) Both B and C

Answer: D) Both B and C

---

4. Multiple Select Question (MSQ)

Which of the following statements are **true** regarding enzyme regulation?
A) Allosteric enzymes do not follow Michaelis-Menten kinetics
B) Phosphorylation can either activate or inhibit enzyme activity
C) In competitive inhibition, Vmax decreases
D) Feedback inhibition is a form of metabolic regulation

Answer: A, B, and D

---

5. Numerical Answer Type (NAT)

A particular enzyme has a turnover number (**kcat**) of **500 s^{-1}** and a total enzyme concentration (**[E]t**) of **0.02 mM**. Calculate the **maximum velocity (Vmax)** of the enzyme reaction in **µmol/min**.
(**Use the formula:** Vmax = kcat × [E]t)

Answer:
Vmax = (500 s^{-1}) × (0.02 mM)
= **10 mM/s**
= **600 µmol/min**