Question #80617

The rate of a standard reaction is 0.00543 M/s at 40 oC. What will the rate be if the temperature is doubled?

A. 0.01086 M/s

B. 0.02172 M/s

C. 0.04344 M/s

D. 0.08688 M/s

E. All of the Above

Answer:

The right answer is D. 0.08688 M/s.

According to the equation [1]:

$$\frac{R_2}{R_1} = Q_{10}^{\frac{T_2-T_1}{10}},$$

where R_1 – is the rate of reaction at 40°C, R_2 – is the rate of reduced reaction, T_1 – is the temperature of standard reaction(T_1=40+273=313 K), T_2 – is the temperature of reduced reaction (T_2=80+273=353 K), Q_{10} – is the Q_{10} temperature coefficient.

For most biological systems, the Q_{10} value is ~ 2 to 3.

$$\frac{R_2}{0.00543} = Q_{10}^{\frac{353-313}{10}}$$

$$\frac{R_2}{0.00543} = Q_{10}^{4}$$

If we suggest that Q_{10} is equal to 2, we get the following:

$$\frac{R_2}{0.00543} = 2^4$$

$$R_2 = 0.00543 * 16 = 0.08688\ M/s$$

So, if we double the temperature of reaction, the rate of reaction has to be equal to 0.08688 M/s (D).

Reference:

[1] https://en.wikipedia.org/wiki/Q10_(temperature_coefficient)