A reaction was found to be zeroth-order in reactant A. If the concentration of reactant A is tripled, with everything else being kept the same, the reaction rate would be:
(a) halved (b) doubled (c) tripled (d) quadrupled (e) none of these

Which of the following orders would carbon-14 atoms follow in their radioactive decays?
(a) zeroth-order (b) first-order (c) second-order (d) half-order (e) none of these

If a reaction follows the rate law: \( \text{Rate} = k \cdot [A]^{\frac{1}{2}} \cdot [B]^{-1} \), what is the overall order of the reaction?
(a) \( \frac{1}{2} \) (b) \( 3/2 \) (c) \( -3/2 \) (d) \( -1/2 \) (e) none of these

A differential rate law describes the relationship between:
(a) \([A]\) & time (b) rate & \([A]\) (c) rate & time (d) \(k\) & temperature (e) none of these

In the reaction, \( 4\text{NH}_3 + 7\text{O}_2 \rightarrow 4\text{NO}_2 + 6\text{H}_2\text{O} \), which substance disappears the fastest?
(a) \(\text{NH}_3\) (b) \(\text{O}_2\) (c) \(\text{NO}_2\) (d) \(\text{H}_2\text{O}\) (e) none of these

For the rate law: \( \text{rate} = k \cdot [A]^2 \cdot [B]^2 \), what would be the units on \(k\)?
(a) \(\text{M}^3 \text{ s}^{-1}\) (b) \(\text{M}^2 \text{ s}^{-1}\) (c) \(\text{M}^{-1} \text{ s}^{-1}\) (d) \(\text{M} \text{ s}^{-1}\) (e) none of these

A linear trend line fit for a first-order reaction to component A can be obtained by plotting which of the following against time?
(a) \([A]^2\) (b) \([A]\) (c) \(\ln [A]\) (d) \(1/[A]\) (e) none of these

The linear form of the Arrhenius equation, \( k = A \cdot \exp(-E_a/RT) \), is given between \(\ln(k)\) versus which of the following?
(a) \(T\) (b) \(E_a\) (c) \(R\) (d) \(1/T\) (e) none of these

The steps in a reaction mechanism are:
(a) infinite (b) time dependent (c) not elementary (d) elementary (e) none of these

Which of the following substances can be added to a reaction without itself being changed to increase the reaction rate?
(a) catalyst (b) reactant (c) product (d) water (e) none of these

The rate constant depends on:
(a) time (b) the A-factor (c) temperature (d) \(R\) (e) none of these

For a reaction with a rate law dependence to just one component, its half-lives remained constant with different initial concentrations, the order of the reaction is:
(a) third-order (b) second-order (c) first-order (d) zeroth-order (e) none of these
PART B: Problems (26 marks).

1. Consider the following data for the reaction of: \( A + B \rightarrow \text{Products} \)

<table>
<thead>
<tr>
<th>Expt. #</th>
<th>[A] (M)</th>
<th>[B] (M)</th>
<th>Rate (M s(^{-1}))</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.273</td>
<td>0.763</td>
<td>2.83</td>
</tr>
<tr>
<td>2</td>
<td>0.273</td>
<td>1.526</td>
<td>2.83</td>
</tr>
<tr>
<td>3</td>
<td>0.819</td>
<td>0.763</td>
<td>25.47</td>
</tr>
</tbody>
</table>

(A) Determine the order of reaction (x) with respect to reactant A.

(B) Determine the order of reaction (y) with respect to reactant B.

(C) Write the differential rate law (DRL) in terms of the two reactants (without solving for the value of k).

2. The rate constant for a second-order reaction is 0.130 M\(^{-1}\) s\(^{-1}\).

(A) If it took 29.6 seconds for the concentration of reactant A to become 0.130 mol/L, what was the initial concentration of reactant A?

(B) Sketch the linear form of the integrated rate law (IRL). Label the axis appropriately. Give the value of the slope and identify the y-intercept.

(C) Starting with the IRL, clearly show the step-by-step sequence (derive) the half-life equation for a second-order reaction.