South Pasadena • AP Chemistry

Name _____
Period ___ Date ___/___/___

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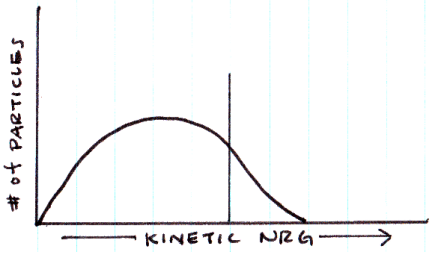
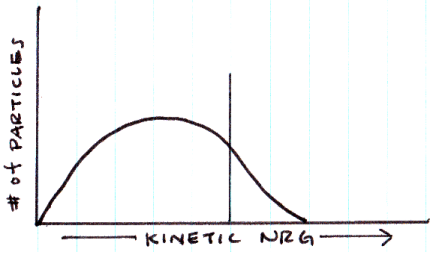
Station 1 – KINETIC ENERGY DIAGRAMS

Draw how the KE diagram would change if:

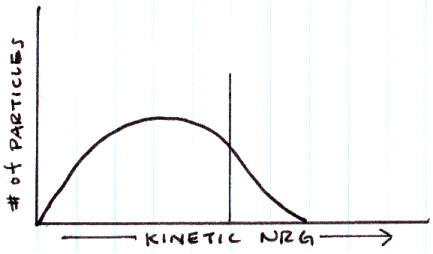
the temperature of the sample is increased.



a catalyst is added to the reaction mixture.



more chemical is added at the same temperature.



What is the name of the vertical line intersecting the graph? _____ _____

Why do particles need kinetic energy to react?

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Station 2 – POTENTIAL ENERGY DIAGRAMS

The energy of the **reactants** is 30 kJ/mol.

ΔH = -20 kJ/mol

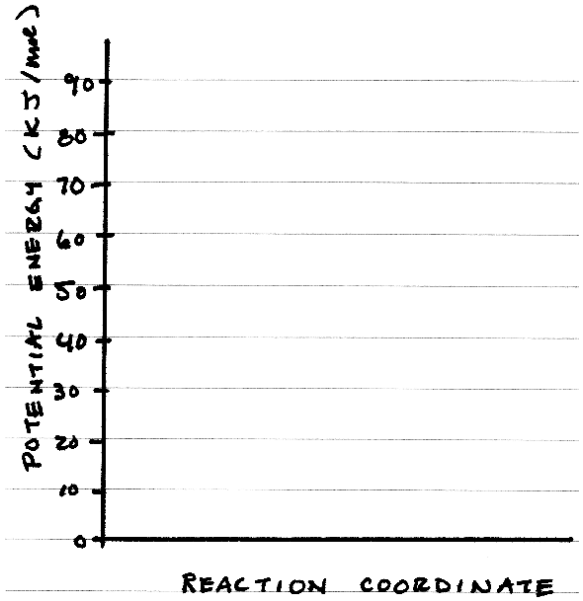
Ea = +40 kJ/mol

Draw the PE curve.

The energy of the **products** is _____

The **activation energy** for the **reverse** reaction is _____

Draw the same curve with a catalyst included. (- - - - - - -)



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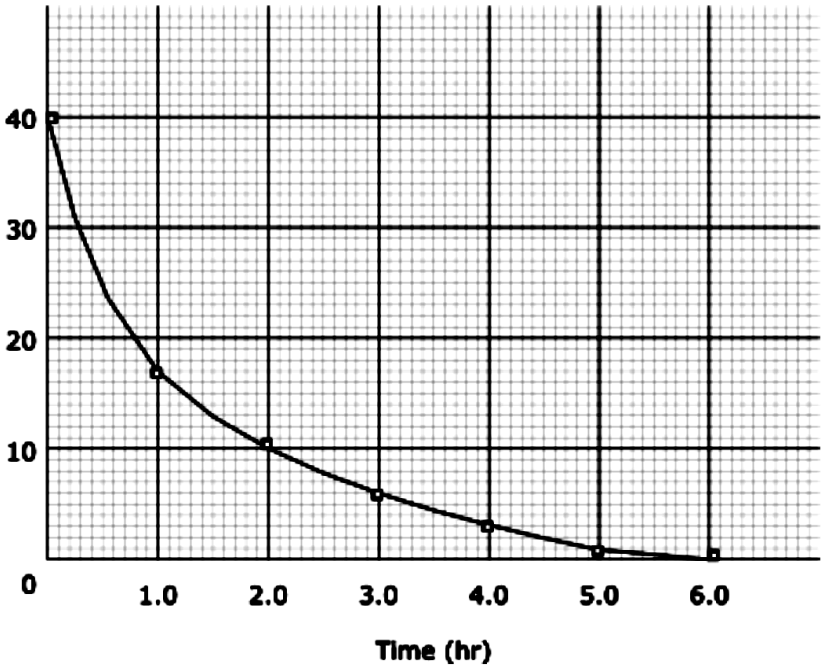
Station 3 – RATE FROM GRAPHS

The vertical axis is [R] in $mol \cdot L^{-1}$



Show your work for these two problems.

The **average** rate of the reaction for the first 2.0 hours is _____.

The **instantaneous** rate of the reaction at 2.0 hours is _____.

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Station 4 – CALCULATING RATES OF REACTION

Consider the combustion of propane, $C_3H_8(g) + 5\ O_2(g) \rightarrow 3\ CO_2(g) + 4\ H_2O(g)$

The rate of disappearance of $O_2(g)$ is 6.4 $mol \cdot L^{-1} \cdot s^{-1}$

What is the rate of disappearance of $C_3H_8(g)$?

What is the rate of appearance of $CO_2(g)$?

What is the rate of appearance of $H_2O(g)$?

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Station 5 – RATE LAWS – THE METHOD OF INITIAL RATES

Here is some initial rate data for the reaction, $A + B \rightarrow 2C$.

[A]	[B]	Rate ($mol \cdot L^{-1} \cdot s^{1}$)
0.40	0.10	3.5×10^{3}
0.20	0.10	1.8×10^{3}
0.20	0.50	4.5×10^{4}

a) Determine the **orders** of reactants A _____ and B _____

b) Write the **rate law** for this reaction: _____

c) Calculate the value of the **rate constant, k**, with **units**. _____

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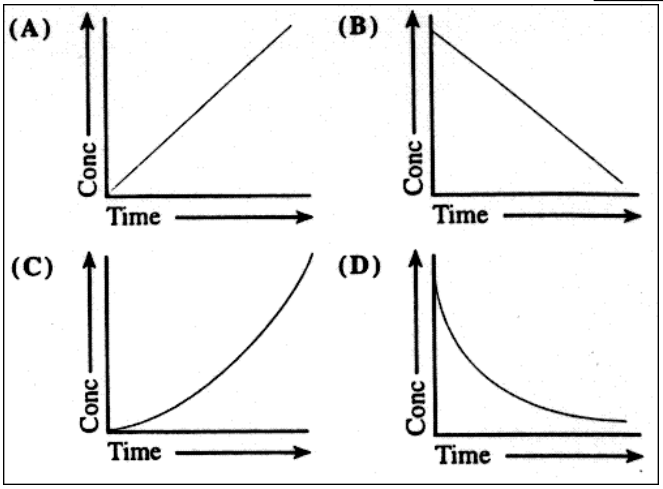
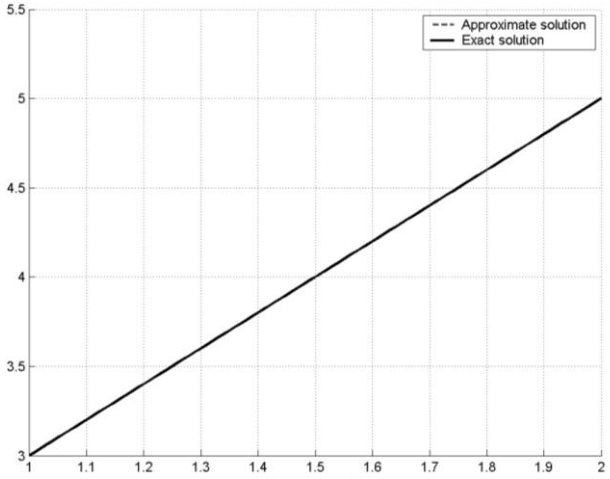
Station 6 – ORDERS OF REACTIONS – GRAPHICAL METHODS

Which graph corresponds to the change in concentration of a reactant that is first order? _____



This graph is a chemical that is second order. The horizontal axis is time. What is the vertical axis? ____



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Station 7 – REACTION MECHANISMS

Consider this reaction mechanism:

$$HCOOH + H_2SO_4 \rightarrow HCOOH_2^+ + HSO_4^-$$
$$HCOOH_2^+ \rightarrow COH^+ + H_2O$$
$$COH^+ + HSO_4^- \rightarrow CO + H_2SO_4$$

a) What is the overall reaction? _____

b) List any "intermediates." _____

c) List any catalysts. _____

d) If the first step is the slow step, what is the rate law? _____

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Station 8 – HALF LIFE PROBLEMS

a) A first-order chemical has a half-life of 8.00 minutes.
How long will it take for 93.75% of this chemical to decay?

b) The reaction X → Y follows first-order kinetics with a half-life of 4.00 minutes. What is the value of k?
If the initial concentration of X is 3.6 M, what is the concentration after 15.0 minutes?

Formula:

$$\ln[A]_t - \ln[A]_0 = -kt$$

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Station 9 – THE ARRHENIUS EQUATION

Calculate the activation energy, E_a, for $N_2O_5(g) \rightarrow 2\ NO_2(g) + ½\ O_2(g)$
given k (at 25°C) = $3.46 \times 10^{-5}\ s^{-1}$ and k (at 50°C) = $1.10 \times 10^{-3}\ s^{-1}$.

Formula:

$$\ln k = \frac{-E_a}{R}\left(\frac{1}{T}\right) + \ln A$$

$$R = 8.31\ \text{J mol}^{-1}\ \text{K}^{-1}$$