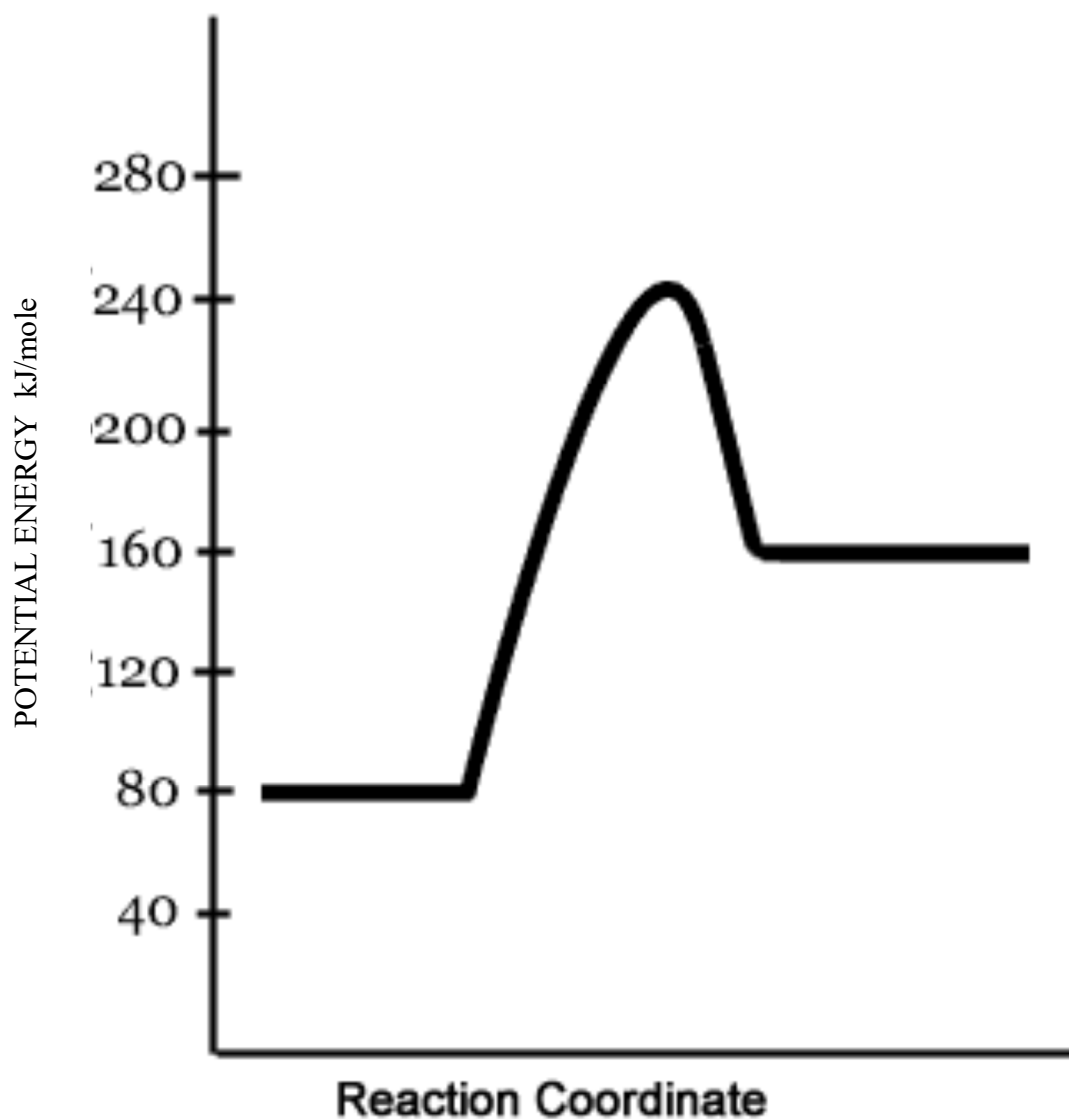


1. What does collision theory of chemical reactions mean in your own words?
2. What are the 4 factors that affect the rate of chemical reactions? At least 1 sentence per factor.
3. All chemical reactions are reversible but some are spontaneously reversible. Explain.
4. Write the balanced thermo-chemical reaction for the production of ammonia gas from the gases nitrogen and hydrogen. Draw in dynamic equilibrium double arrows. (Include actual energy in kJ from Table I)
5. Define and describe in your own words what dynamic equilibrium means. What symbol is used between the reactants and the products?

Use the potential energy diagram below to answer the questions below.

1. What is the potential energy of the reactants in kJ/mol?
2. What is the potential energy of the products in kJ/mol?
3. Is the reaction exothermic or endothermic?
4. What is the  $\Delta H$  for this reaction?
5. For this reaction, would the energy of reaction be written with the products or with the reactants in a balanced chemical equation?
6. Would the  $\Delta H$  for the reaction change if a catalyst was added?
7. What is the potential energy in kJ/mol of the activated complex?
8. What is the activation energy for this reaction?
9. Does the activation energy change if a catalyst is added to the system?
10. LABEL the diagram: indicate the potential energy of the products and the reactants, the activated complex (put a dot where it belongs) and label it AC. Draw two arrows, one for the  $\Delta H$  and one for the activation energy. Label them AE and  $\Delta H$ . Finally, draw in a dotted line to show the reaction pathway when a catalyst is used.



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Draw two complete POTENTIAL ENERGY diagrams for the formation of hydrogen iodide from the 2 gases hydrogen + iodine, and then for the synthesis of aluminum oxide. Include titles, axis labels, curves, AE, AC, H, catalyst dotted line, "R" + "P" for reactants and products, and state ENDO OR EXO near each curve.



3. Explain the difference between a catalyst & an inhibitor in a chemical reaction.

Assuming you have this dynamic equilibrium reaction, show with arrows which way the reaction shifts with each stress that we apply to it. The first one is done for you to show you the arrow.



Add butane →  
Add carbon dioxide

Add heat  
Decrease pressure

Add oxygen  
Remove carbon dioxide

Remove heat  
Remove butane

Increase pressure  
Add a catalyst

Remove oxygen  
Add carbon dioxide

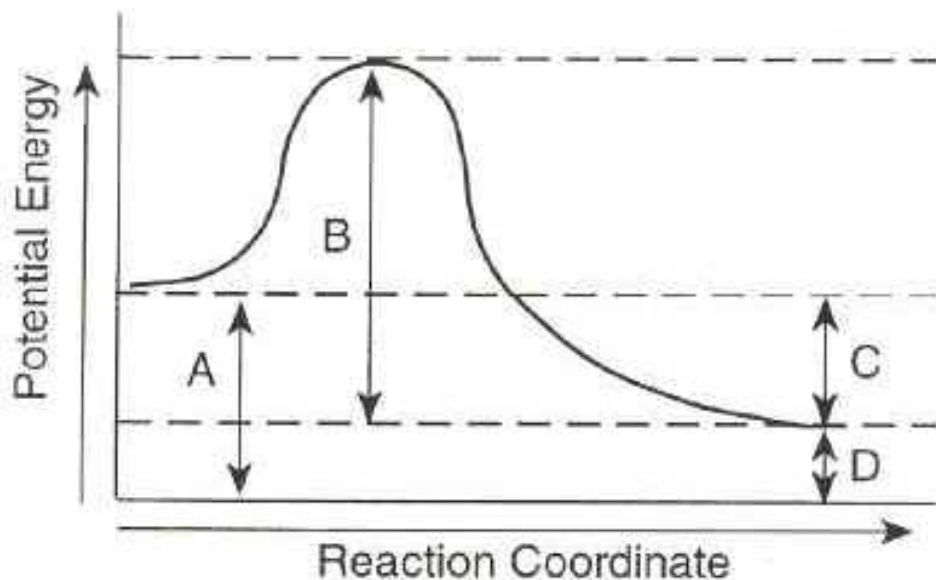
Remove water  
Add water

This graph below from an old regents exam expects you to think about potential energy diagrams. The letters have these values: A = 30 kJ/mol B = 50 kJ/mol C = 20 kJ/mol D = 10 kJ/mol

To answer the questions, please use NUMERIC VALUES, not letters.

1. What is the potential energy of the reactants?
2. What is the potential energy of the products?
3. What is the potential energy of the activated complex?
4. Is the  $\Delta H$  positive or negative?
5. What is the heat of reaction?  
(Look at Table I, or ask, what does heat of reaction mean?)
6. How much energy is required to start this reaction?
7. What is this energy in question #6 called?
8. Is this reaction endothermic or exothermic?
9. Could the reaction:  $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$  be represented by this diagram? (yes or no)
10. What does Heat of Solution mean?

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