Potential Energy Diagrams

Graph 1: Use the potential energy diagram for the reaction X + Y -> Z to complete the chart below.
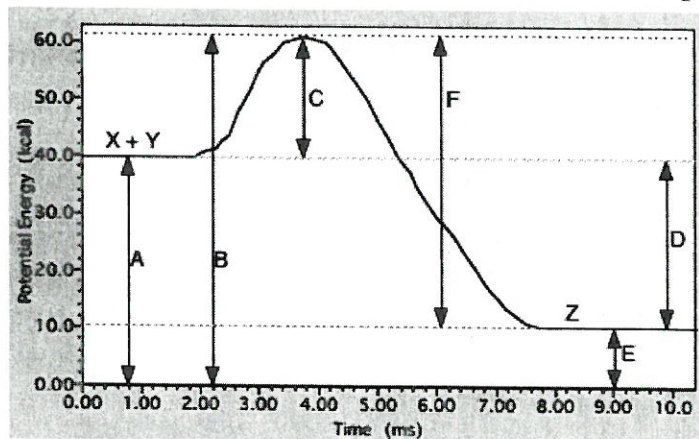
| Letter	Term	Description
A	HR	enthalpy of R
B	AC enthalpy	Ep content of the AC
C	EA	activation energy of foreward rxn
D	ΔH	heat of rxn
E	Hp	enthalpy of P.

Graph 2

1. Draw a potential energy diagram for an endothermic reaction.
2. Label your drawing with the following letters:

   A=PE of products   D=Energy of activation
   B=PE of reactants   E=Heat of reaction
   C=PE of the activated complex

   ENDOTHERMIC

H OR
EP Hp
(kJ)

HR

D

R
B

P

C

A

~in progress
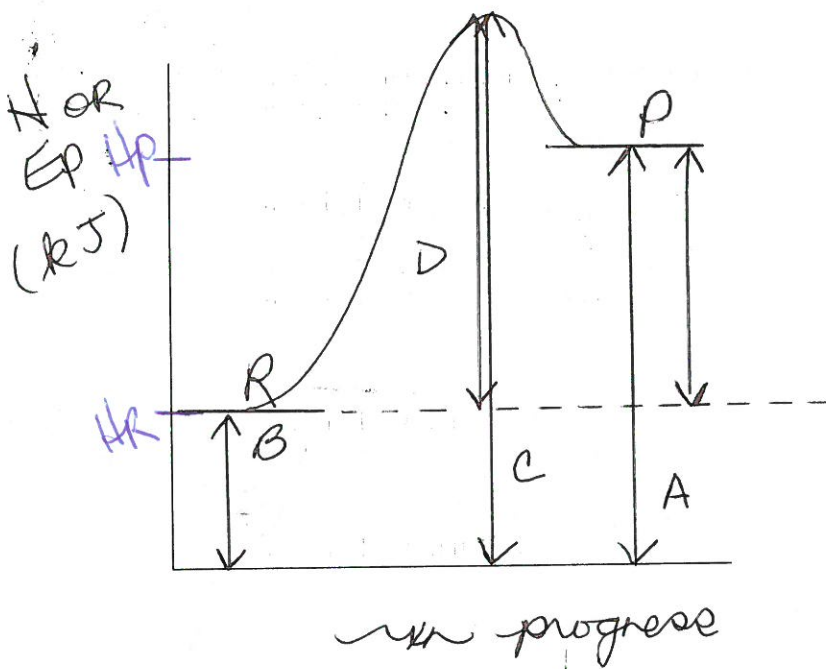
Graph 3: Use the potential energy diagram for the reaction A + B -> C + D to answer the following questions.

AC

1. Is the reaction exothermic or endothermic?

exo

2. What is the value of ΔH?

$\Delta H = 10° \overset{0}{=} 40° \overset{0}{=} -30.0 kcal$
$= Hp - HR$
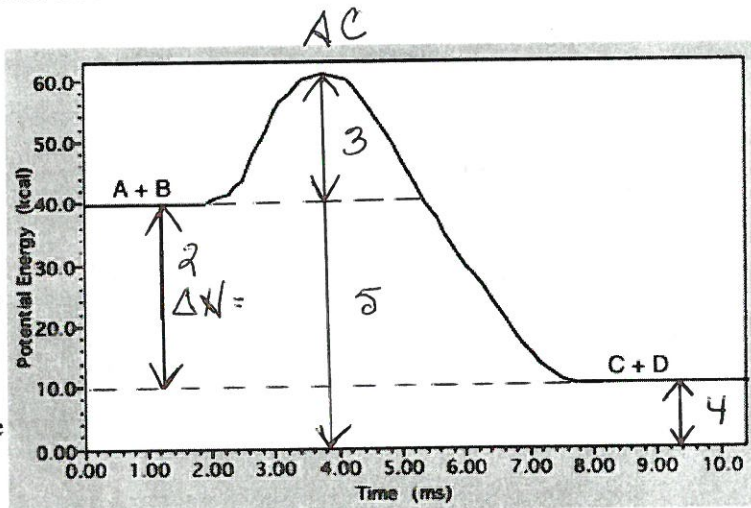
3. What is the value of the activation energy of the reaction?

20.0 kcal

4. What is the potential energy of the products?

Hp = 10.0 kcal

5. What is the potential energy of the activated complex?

60.0 kcal

A + B

3

2

$\Delta H =$

5

C + D

4

(Graph: Potential Energy (kcal) vs Time (ms), y-axis 0.00–60.0, x-axis 0.00–10.0)

Graph 4: Use the potential energy diagram for the reaction Y + R -> Z + M to answer the following questions.

1. Is the reaction exothermic or endothermic?

endo

2. What is the value of the activation energy of the uncatalyzed reaction?

3. What is the value of the activation energy of the catalyzed reaction?

57.0 kcal - 10.0 kcal = 47.0 kcal

4. What is the potential energy of the activated complex of the catalyzed reaction?

~54.0 kcal

5. How does the ΔH for the catalyzed reaction compare to ΔH for the uncatalyzed reaction?

they are the same! a catalyst does not affect:
· HR & thus ΔH
· Hp

Uncatalyzed reaction

Catalyzed reaction

Z + M

Y + R

ΔH cat = ΔH uncat

(Graph: Potential Energy (kcal) vs Time (ms), y-axis 0.00–60.0, x-axis 0.00–10.0)