

Unit 1 rates

Go to question

- An experiment was carried out at four temperatures. The table shows the times for the reaction to occur.
- Using the information on the table calculate the average reaction rate during the first 20 secs.
- If graph **I** shows the reaction between excess Mg and 50 cm³ of 1.0 mol l⁻¹ HCl, which would show the reaction for excess Mg and 50 cm³ of 2.0 mol l⁻¹ HCl,?
- The enthalpy change for a chemical reaction is shown in the diagram. The enthalpy change for this reaction can be represented by.
- Which of the following is a correct interpretation for an increase in temperature, from T 1 to **T 2**?
- The potential energy diagram a chemical reaction is shown. What would the ΔH , in kJ mol⁻¹, for the forward reaction be?
- The diagram shows the potential energy diagram for a reaction. Which diagram best shows (in red) the potential energy diagram for the same reaction using a catalyst
- The correct sequence for the action of a catalyst is



- 1 An experiment was carried out at four temperatures. The table shows the times for the reaction to occur.

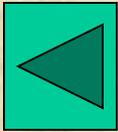
Temp/ $^{\circ}\text{C}$	15	30	50	60
Time/s	80	40	30	20

- a. The rate of reaction is directly proportional to the temperature
- b. The reaction is endothermic
- c. The activation energy decreases with increasing temperature
- d. A small rise in temperature produces a large increase in the reaction rate.



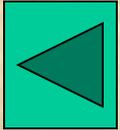
a hint!!!!

If the temperature doubles does the time double?



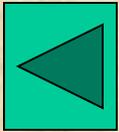
a hint!!!!

Temperature increases the kinetic energy of the molecules.



a hint!!!!

An endothermic reaction cools its surroundings.



Correct because.....

Temp/ $^{\circ}\text{C}$	15	30	50	60
Time/s	80	40	30	20

As the temperature doubles, the decrease in time halves.
So a small rise in temperature produces a large increase in the rate of reaction.



2 Using the information on the table calculate the average reaction rate during the first 20 secs.

Conc/mol l ⁻¹	0.4	0.2	0.1	0.075
Time/s	0	10	20	30

a. $0.02 \text{ mol l}^{-1} \text{ s}^{-1}$

b. $0.0015 \text{ mol l}^{-1} \text{ s}^{-1}$

c. $0.015 \text{ mol l}^{-1} \text{ s}^{-1}$

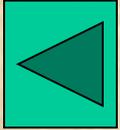
d. $0.15 \text{ mol l}^{-1} \text{ s}^{-1}$



a hint!!!!

1st hint

Note the concentration **change** after 20 secs.



2nd hint

Note the units , $\text{mol l}^{-1} \text{s}^{-1}$, mol l^{-1} **per second**



3rd hint

Divide the change in concentration by the change in time



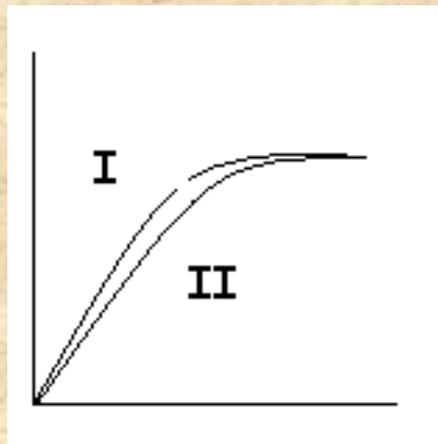
Correct because..

$$\begin{aligned} \text{The average reaction rate} &= \frac{\text{Overall change in concentration}}{\text{Overall change in time}} \\ &= \frac{0.4 - 0.1}{20} \\ &= 0.015 \text{ mol l}^{-1} \text{ s}^{-1} \end{aligned}$$

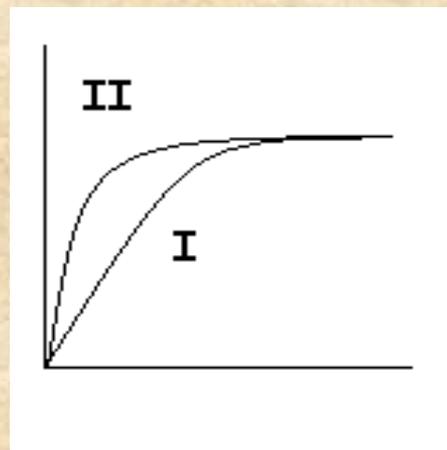


3 If graph I shows the reaction between excess Mg and 50 cm^3 of $1.0 \text{ mol l}^{-1} \text{ HCl}$, which would show the reaction for excess Mg and 50 cm^3 of $2.0 \text{ mol l}^{-1} \text{ HCl}$, graph II?

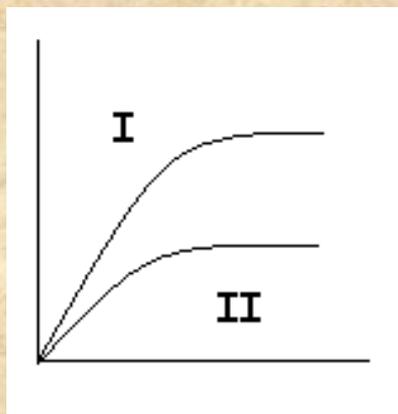
a.



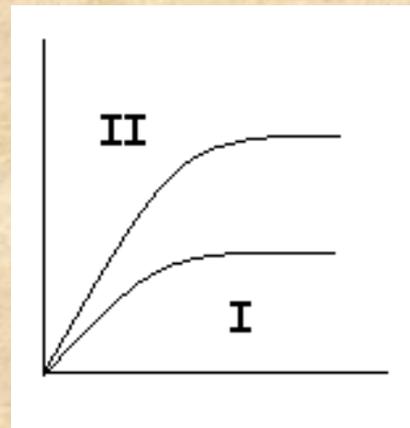
b.



c.

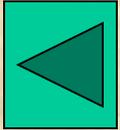


d.



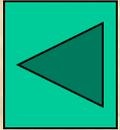
a hint!!!!

The slope of the graph indicates how quickly the reaction is taking place.



a hint!!!!

The mass of Mg is still in excess and the amount of acid has increased?.

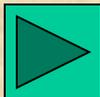
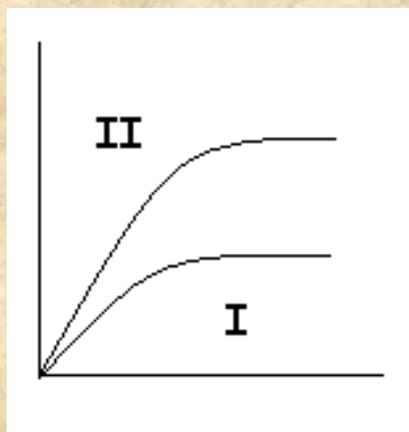


If graph **I** shows the reaction between excess Mg and 50 cm³ of 1.0 M HCl, which would show the reaction for excess Mg and 50 cm³ of 2.0 mol l⁻¹ HCl, graph **II**?

Correct because.....

Excess Mg and 50 cm³ of 2.0 mol l⁻¹ HCl increases the concentration of the acid, and the amount of magnesium remains in excess. So twice the amount of hydrogen is produced.

d.



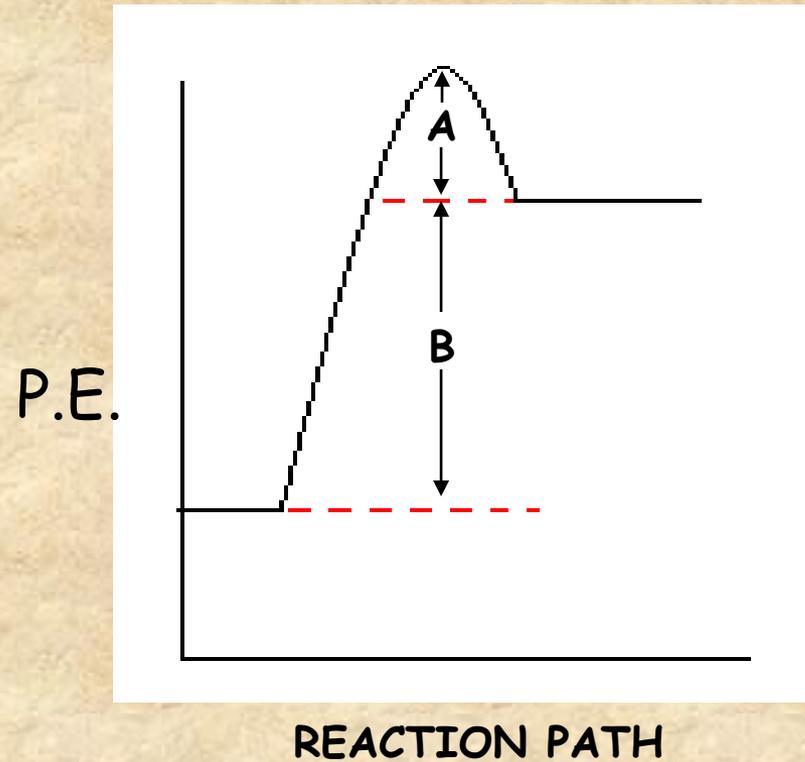
4 The enthalpy change for a chemical reaction is shown in the diagram. The enthalpy change for this reaction can be represented by.

a. $A + B$

b. A

c. B

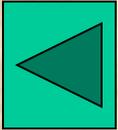
d. $B - A$



a hint!!!!

1st hint

Enthalpy relates to the overall change in energy.



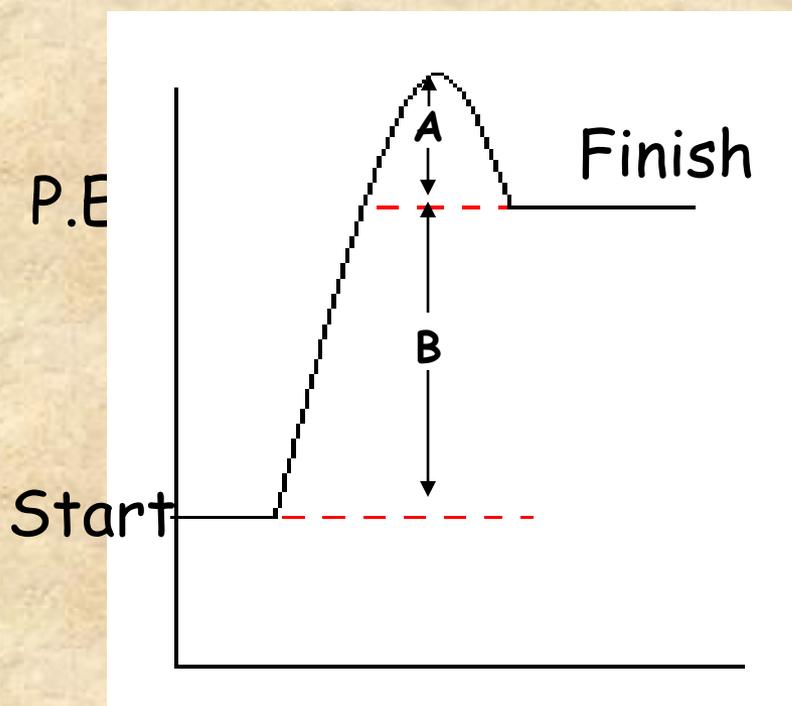
2nd hint

A is the activation energy



The enthalpy change for a chemical reaction is shown in the diagram. The enthalpy change for this reaction can be represented by. **Answer C**

Correct because...

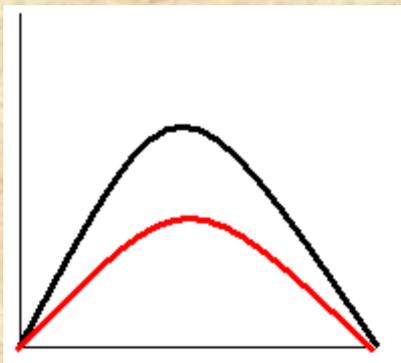


B Enthalpy is the change in energy that takes place during a chemical reaction.



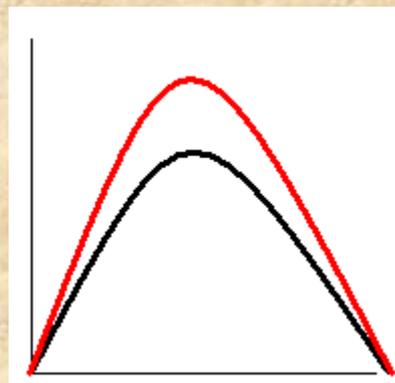
5 Which of the following is a correct interpretation for an increase in temperature, from T_1 to T_2 ?

a.
No
Molecules



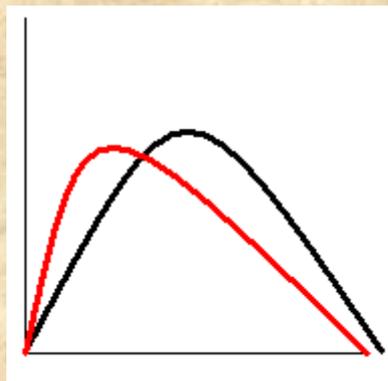
Kinetic energy

b.
No
Molecules



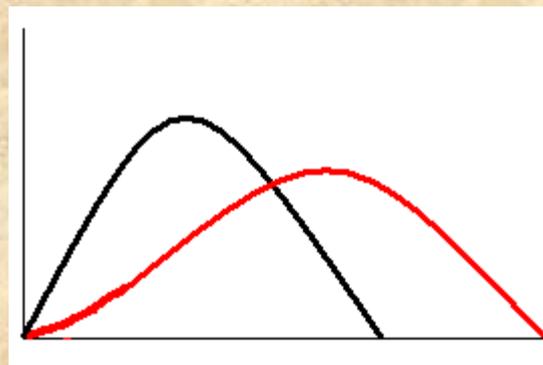
Kinetic energy

c.
No
Molecules



Kinetic energy

d.
No
Molecules



Kinetic energy



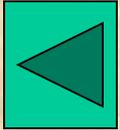
a hint!!!!

Does the number of molecules change?



a hint!!!!

Does increasing the temperature decrease the energy of the molecules?



Which of the following is a correct interpretation for an increase in temperature, from T_1 to T_2 ?

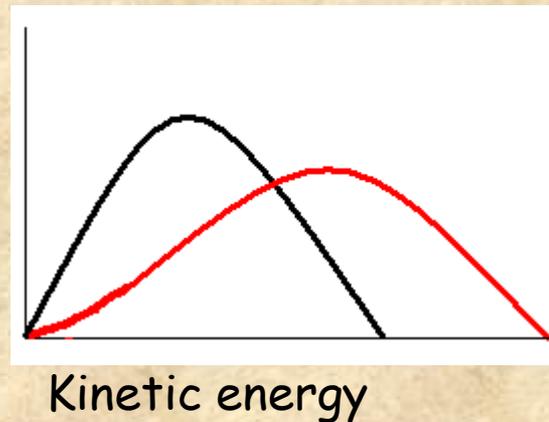
Correct because.....

As temperature is a measure of the average kinetic energy of the molecules, the graph needs to show

- i) That the overall number of molecules does not change
- ii) That the number of molecules with a greater K.E. increases.

d.

No
Molecules



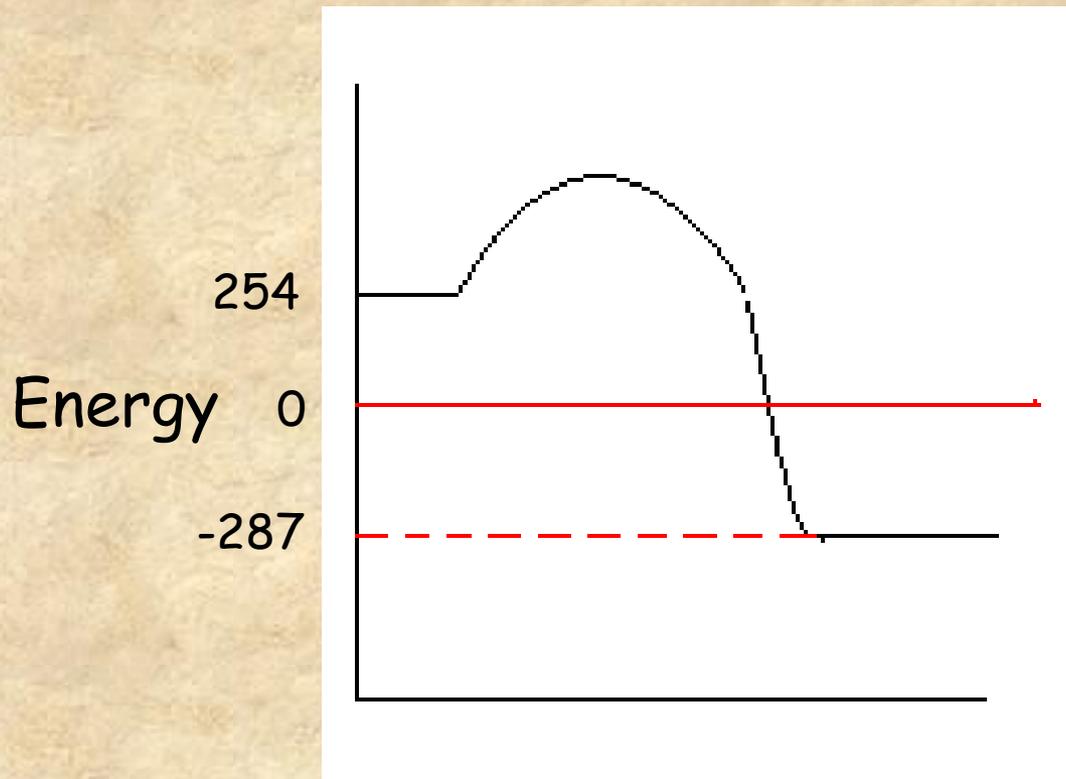
6 The diagram shows the potential energy diagram for a chemical reaction. What would the ΔH , in kJ mol^{-1} , for the forward reaction be?

a. -541 kJ mol^{-1}

b. 541 kJ mol^{-1}

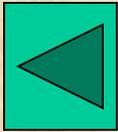
c. -287 kJ mol^{-1}

d. 254 kJ mol^{-1}



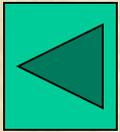
a hint!!!!

Is this an endothermic or an exothermic reaction?

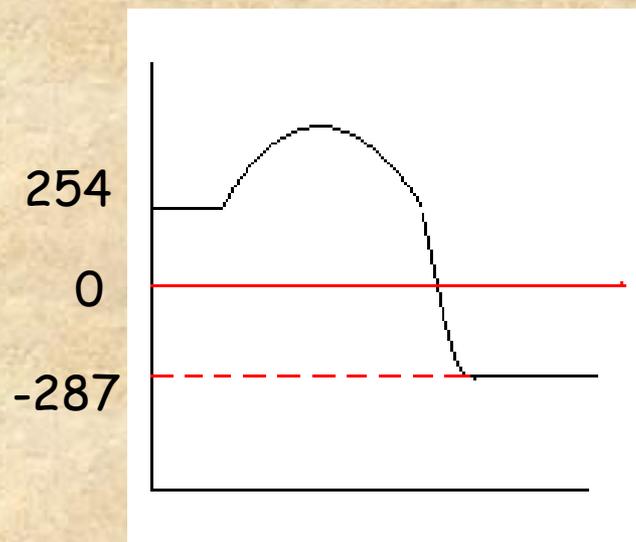


a hint!!!!

ΔH is the change in the overall Enthalpy



Correct because.....



As ΔH is the change in energy during a chemical reaction

$$\begin{aligned} &(-287) - 254 \\ &= -541 \text{ kJ mol}^{-1} \end{aligned}$$

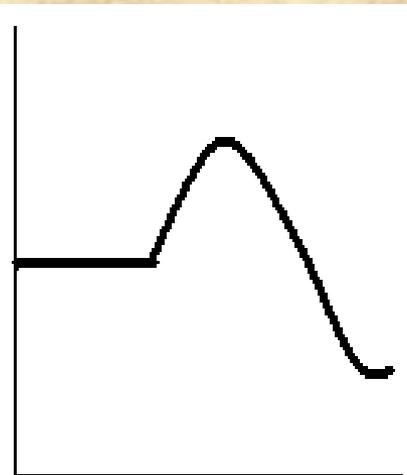
An exothermic reaction



7

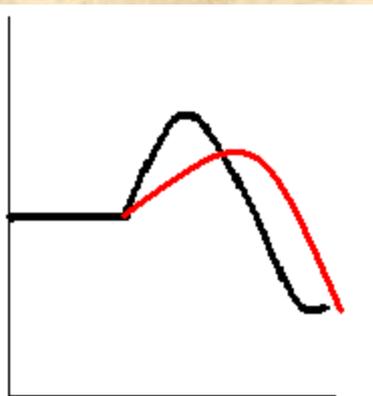
The diagram shows the potential energy diagram for a reaction. Which diagram best shows (in red) the potential energy diagram for the same reaction using a catalyst?

p.e

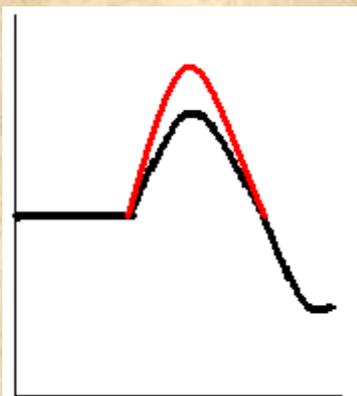


Reaction pathway for the uncatalysed reaction

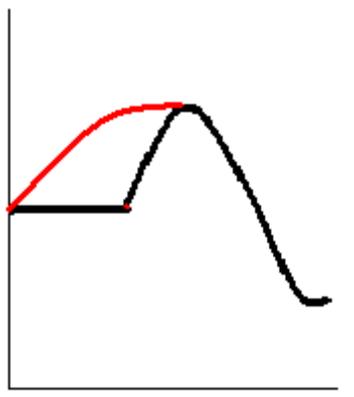
a.



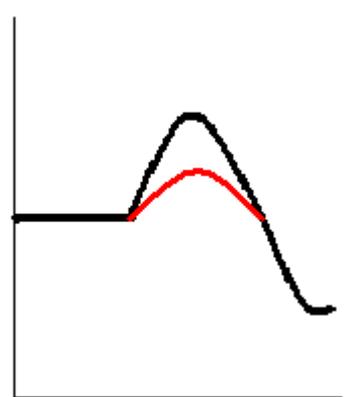
b.



c.

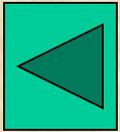


d.



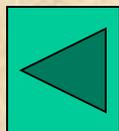
a hint!!!!

What do catalysts do the activation energy?



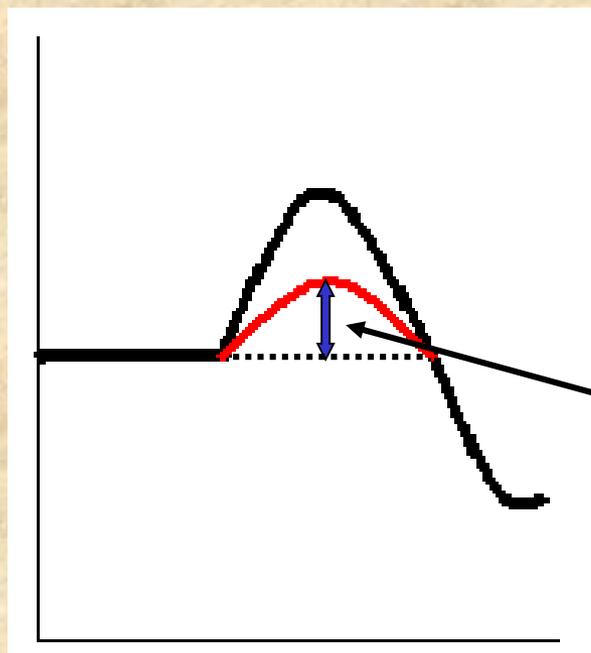
a hint!!!!

Think about the original reaction pathway.



The diagram shows the potential energy diagram for a catalysed reaction. Which diagram best shows the potential energy diagram for the same reaction, but catalysed?

Correct because.....



A catalyst is not used up in a chemical reaction. It does lower the activation energy



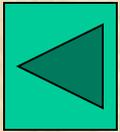
8 The correct sequence for the action of a catalyst is

- a. The reactant molecules hit the catalyst's surface, bonds break and a new compound is formed
- b. The reactant molecules attach themselves to the surface of the catalyst, bonds weaken, the reactant molecules break apart and new product bonds are formed
- c. The reactant molecules attach themselves to the surface of the catalyst, the surface changes, new bonds are formed and new compound are formed.
- d. The reactant molecules have their bonds broken between them at the surface of the catalyst. A new compound is formed when the overall energy of the new bonds equal to the overall energy of the old bonds.



a hint!!!!

What is important about a catalysts' surface?



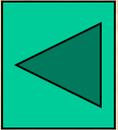
a hint!!!!

A catalyst can be used over and over again, why?



a hint!!!!

Chemical reactions can be either endothermic or exothermic.



The correct sequence for the action of a catalyst is

Correct because.....

A catalyst offers a surface to the reactant molecules. These molecules bind to the surface. In doing so the bonds holding the reactant molecules together are weakened. When the product molecule has been formed, the weak bonds holding the particles to the catalyst break, releasing the new molecule.

