

## CCT Weekly Science Practice

### An acquaintance with Catalysts

A large portion of Chemistry is about the reaction of one substance with another to yield one or more product(s). You will study more about these chemical reactions in your Class X Science curriculum. In this week's science practice, we want to acquaint you with **catalysts**.

At times, substances take very long to react with each other, sometimes years. Now, when we add catalysts to the situation, these reactions speed up. Actually, certain reactions need some energy (activation energy) to take place. If this energy is not there, then the reaction may not occur or take a long, long time. So, special substances called catalyst are added and these lower the activation energy of the reaction. Sometimes, catalysts are used to slow down the reactions too. Hence, catalyst can be defined as *substances that can be added to a reaction to increase the reaction rate without getting consumed in the process*. These are extensively used in industries- chemical, petroleum, pharmaceuticals, etc.

And guess what, at this very moment, there are many catalyst doing their job in your body. Enzymes are natural catalyst and you will encounter many of them as you study Biology- the digestive enzymes, enzymes that help our DNA to replicate or the enzymes that help the liver to break down toxic substances in the body. As Laurel Hamers in the article in Science News for Students puts, *Catalysts are the unsung heroes of the chemical reactions that make human society tick*.

In fact, you may have heard the word being used in common parlance too. For example, *Children can become catalysts of change towards a sustainable planet*.

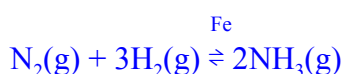
### Question 1:

Which one of the following is incorrect for a catalyst?

- (a) It initiates a reaction
- (b) It lowers/ increases activation energy
- (c) It combines with the reactants

### Question 2:

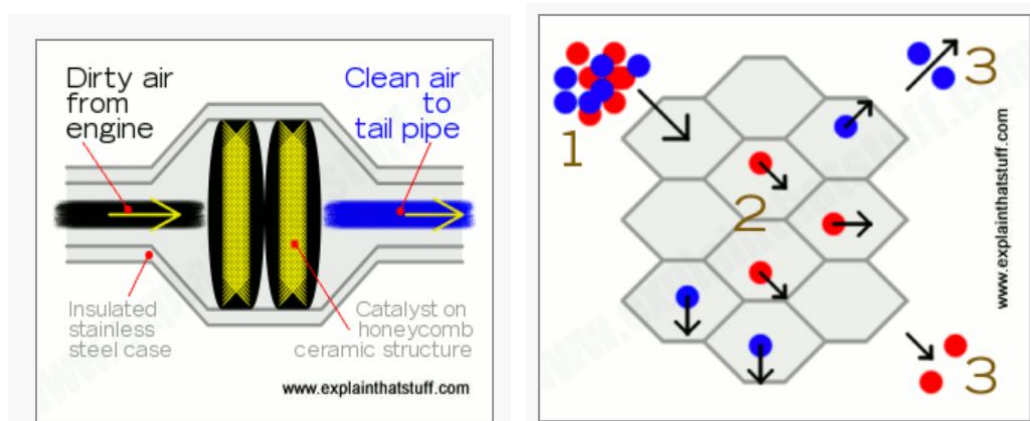
Ammonia (NH<sub>3</sub>) is an important chemical for industry and is used to produce fertilizers, other chemicals and many more substances. It is prepared by combining Nitrogen (N<sub>2</sub>) present in air and Hydrogen (H<sub>2</sub>) that is obtained as a by-product of natural gas (methane). The reaction is written as stated below:



For the above reaction to happen, which substance acts as a catalyst?

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You must have heard about *catalytic converters*. These are devices that are fitted in vehicles to control the toxic emission of gases. Vehicles running on petroleum (hydrocarbons) produce gases like carbon dioxide, carbon monoxide and nitrogen oxides besides others. These toxic gases are directed into the catalytic converter that has a honeycomb structure coated with the catalysts. The catalyst helps to break down the toxic nitrogen oxides and carbon monoxide into harmless nitrogen, carbon and oxygen that can be safely emitted. PGM (Platinum Group Metals) are used in Catalytic Converters.



**Question 3:**

Catalytic converters have a honey-comb structure coated with catalysts. Toxic gases are passed through this structure. Assess the need for honeycomb design or structure in the Catalytic converters?

- (a) It reduces the load on the engine
- (b) It increases the surface area which in turn enhances the efficiency of the reaction
- (c) It doubles the efficiency of the engine.

**Question 4:**

Some metals are used as catalyst in the catalytic converter. Which of the following combination of elements do you suggest can be used in the Catalytic Converter?

- a) Gold & Phosphorous
- b) Gold & Sulphur
- c) Platinum & Rhodium
- d) Platinum & Carbon

**Question 5:**

If given a choice, would you prefer to purchase a car without Catalytic convertor which is cheaper or a car with a Catalytic convertor which is much more expensive? Justify your choice.

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**Answer 1: (c)**

Catalysts only speed up a reaction. They do not combine with the reactants, nor are they a part of the product of the reaction.

**Answer 2:**

Iron is the catalyst for this reaction. It is not used up during the reaction. It only speeds up the process.

**Answer 3: (b)**

It increases the surface area which in turn enhances the efficiency of the reaction

**Answer 4: (c)**

c) Platinum & Rhodium

**Answer 5:**

With Catalytic Convertor as it causes less pollution.

Source of Image: <https://www.explainthatstuff.com/catalyticconverters.html>

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