

# NCERT/CBSE CHEMISTRY CLASS 11 textbook

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Solutions/Answers to NCERT/CBSE CHEMISTRY Class 11(Class XI) textbook

## CHAPTER NINE

### HYDROGEN

9.36 What do you understand by the terms:

**(i) Hydrogen economy :-** The **hydrogen economy** is a proposed widespread system of delivering the energy needed for motive power (cars, boats, airplanes. hydrogen economy would greatly reduce the emission of carbon dioxide and therefore play a major role in tackling global warming.

**(ii) Hydrogenation :-** The addition of hydrogen to an alkene or alkyne (unsaturated) containing double or triple bond between the two carbon atom results in the formation of an alkane which is a saturated hydrocarbon.

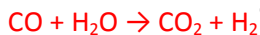
A simple hydrogenation reaction is:



alkene plus hydrogen yields an alkane

**(iii) 'syngas' :-** This is a gas mixture that comprises of carbon monoxide and hydrogen. The syngas can be produced due to the gasification of a carbon containing fuel to a gaseous product that has some heating value. Some of the examples of syngas are as follows – gasification of coal, waste to energy gasification, steam reforming of natural gas to generate hydrogen.

**(iv) Water-gas shift reaction :-** The water-gas shift reaction is a chemical reaction in which carbon monoxide reacts with steam in the presence of a catalyst to form carbon dioxide and hydrogen.



**(v) Fuel-cell :-** A fuel cell is a device which converts the energy produced during combustion of fuel into electrical energy. Hydrogen is used as a fuel cell in oxy hydrogen fuel cells. This hydrogen fuel cell does not cause any pollution and the large amount of energy which is evolved is converted to electrical energy.

As a result of tetrahedral arrangement of  $\text{H}_2\text{O}$  molecules in the solid state, the ice structure extends in three dimensions. Further the molecules of  $\text{H}_2\text{O}$  are not packed closely as hydrogen bonds between oxygen and H atoms are longer than covalent bonds between them. This results in vacant spaces being present in the crystal structure. It gives rise to an open cage like structure for ice, having a larger volume for the given mass of water. Thus, the density

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