subsequently grow to form precipitation-sized particles. Gases are transferred to the near-surface region of both cloud and precipitation elements and are incorporated by dissolution and adsorption. Small particles may be scavenged in a similar fashion in clouds. Particles are also collected by falling raindrops and snowflakes through processes of interception and impaction.

The discussion here pertains primarily to the atmospheric constituents which are involved in the acidic deposition phenomenon: sulfur, as SO_2, SO_4^{2-}; nitrogen, as NO, NO_2, HNO_3, NO_3^-, NH_3, NH_4^+, PAN; and hydrogen ion, H^+. Although other atmospheric pollutants, e.g. trace metals and organic materials, are removed by similar mechanisms, the efficiencies of the removal processes involved will depend on their physical and chemical properties; thus, they might behave somewhat differently.

Figure 5.2 shows schematically the pathways by which the various acidic constituents are deposited. Dry deposition is an important pathway for the gases SO_2, HNO_3, NH_3 and PAN; some evidence exists that the deposition of particulate SO_4^{2-}, and perhaps NO_3^- and NH_4^+, may rival that of the corresponding gaseous precursors on occasion. Wet deposition is an important pathway both for the gases SO_2 and NH_3, via the mechanism of in-cloud chemical reactions, and for HNO_3 and the particulate forms SO_4^{2-} and NH_4^+. In the case of the dry deposition of gases and NH_4^+, chemical or biological reactions are required at the receptor in order to release hydrogen ion; whereas, in the case of precipitation, the free hydrogen ions associated SO_4^{2-} and NO_3^- and are delivered directly to the receptor. It is important to note that non-acidic constituents, including alkaline ones such as calcium carbonate, are delivered to the surface by a similar range of processes and that from a receptor response point of view, it is the total loading from the atmosphere which must be taken into account.