(b) Double replacement; $2CrBr_3 + 3K_2SO_4 \rightarrow Cr_2(SO_4)_3 + 6KBr$
(c) $AuI_3 \rightarrow Au + I_2$

USING THE FEATURE

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Rust is oxidized iron. It has no strength and flakes off. But this is not true of all oxides. Aluminum, for example, is much more reactive than iron. Yet, it forms a transparent protective layer of aluminum oxide at its surface. This prevents further corrosion of the aluminum under many conditions. Now consider chromium—its oxide is as good as aluminum at protecting its surface. In addition, it has a higher lustre and makes a better finish than aluminum. So why not just chrome-plate everything? The answer is that it works well until the metal gets scratched. Then, the iron below is exposed and will corrode.

That is why stainless steel is such an excellent product. The chromium is melted right into the iron. Every part of the alloy has both iron and chromium present. You cannot tell by looking whether it is chromium or iron you see on the surface. What happens with steel is that, at the surface, the iron corrodes away, leaving an invisible layer of chromium oxide that protects the object from corrosion. When this metal is worn away, such as when a knife is sharpened, more iron and chromium atoms are exposed. Again, the iron corrodes away and a new layer of pure chromium oxide forms. In this way, steel is said to "heal" itself.

Science Watch Answers

1. Iron contains only iron atoms; steel contains carbon as well as iron; and stainless steel contains other elements, such as chromium. Iron is soft, steel is hard, and stainless steel is hard and resistant to corrosion.
2. (a) Iron oxide
   (b) Rust has no strength of its own and flakes off, exposing new iron to the possibility of corrosion.
3. Chromium atoms react with oxygen to form chromium oxide, which forms a thin, invisible layer on the surface of steel. This layer protects steel from corroding further.

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Check Your Understanding Answers

Checking Concepts

1. (a) Neutralization
   (b) Synthesis
   (c) Double replacement
   (d) Synthesis
   (e) Combustion
   (f) Double replacement
   (g) Single replacement
   (h) Neutralization
   (i) Decomposition
   (j) Single replacement

Understanding Key Ideas

2. In combustion, the compound is an organic compound containing carbon, hydrogen, and possibly oxygen. Also, the element in a combustion reaction is oxygen. In a single replacement reaction, the compound is inorganic. There is a slight overlap between these two classifications, in that a rapid reaction of anything with oxygen can be called combustion. (For the purpose of this course, combustion is restricted to an organic compound reacting with oxygen.)
3. The reaction of iron metal with oxygen is classified as synthesis in this course. However, if the reaction happens quickly, it could be considered combustion.
4. (a) Synthesis
   $4Na + O_2 \rightarrow 2Na_2O$
   (b) Double replacement
   $Na_2SO_4 + CaCl_2 \rightarrow 2NaCl + CaSO_4$
   (c) Combustion
   $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$
   (d) Neutralization
   $H_2SO_4 + 2KOH \rightarrow K_2SO_4 + 2H_2O$
   (e) Decomposition
   $2AlCl_3 \rightarrow 2Al + 3Cl_2$
   (f) Single replacement
   $3Cd + 2Au(NO_3)_3 \rightarrow 3Cd(NO_3)_2 + 2Au$
   (g) Double replacement
   $Sr(OH)_2 + PbBr_2 \rightarrow SrBr_2 + Pb(OH)_2$
   (h) Combustion
   $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$
   (i) Synthesis
   $2N_2 + 3O_2 \rightarrow 2N_2O_3$
   (j) Single replacement
   $2HNO_3 + Zn \rightarrow Zn(NO_3)_2 + H_2$
5. (a) Synthesis
   $6Na + N_2 \rightarrow 2Na_3N$