Extracting metals: teacher notes and answers

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The worksheets can be used to scaffold pupils' understanding and check where misconceptions are arising. **Answers to the worksheets are provided below.**

Complete one worksheet at a time then go through the answers with the class to identify any areas they are struggling with or misconceptions. Complete the second and third worksheets to ensure the concept is mastered.

Note: while malachite is copper carbonate hydroxide, the worksheet uses copper carbonate to keep the chemistry accessible.

Extracting iron

1. An ore is a rock that contains enough of a certain metal to make it worthwhile extracting.
2. Iron oxide + carbon → iron + carbon dioxide
3. Iron oxide and carbon
4. Iron and carbon dioxide
5. Reduction
6. Oxidation
7. Iron began as part of the compound iron oxide. After the reaction with carbon, iron was displaced from the compound to form the element iron.
8. Iron has been reduced from a compound into an element.
9. Carbon began as an element. Carbon reacted with iron oxide to produce the carbon compound carbon dioxide.
10. Carbon has gained oxygen and been oxidised from an element to form the compound carbon dioxide.
11. Oxygen was part of a compound, iron oxide at the start and is still part of a compound at the end, carbon dioxide.
12. Oxygen was neither reduced nor oxidised.
13. Iron has been reduced from an ion to an atom.

Extracting lead

1. Lead sulfide + carbon → lead + carbon disulfide
2. Reduction
3. Oxidation
4. Lead began as part of the compound lead sulfide. After the reaction with carbon, lead was displaced from the compound to form the element lead.
5. Lead has been reduced from part of a compound to an element
6. Carbon began as an element. Carbon reacted with lead sulfide to produce the carbon compound carbon disulfide.
7. Carbon has been oxidised from an element to the compound carbon disulfide.
8. Sulfur was part of a compound at the start, lead sulfide and at the end carbon disulfide.
9. Sulfur was neither reduced nor oxidised.
10. This is a redox reaction because the lead was reduced from lead sulfide to lead and the carbon was oxidised from carbon to carbon disulfide.
11. The lead ions in the lead sulfide have been reduced to lead atoms in the metal element.
12. Yes, this is a redox reaction even without oxygen. The lead has still changed from an ion/part of a compound to an atom/part of an element. The carbon has been oxidised. Reduction and oxidation don't necessarily need oxygen.

Extracting copper

1. $CuCO_3 \rightarrow CuO + CO_2$
2. All the reactants and products are compounds.
3. Nothing has been reduced or oxidised.
4. Redox reaction is a reaction with both reduction and oxidation taking place.
5. Copper oxide + carbon → copper + carbon dioxide
6.
    a. The copper has been reduced and lost the oxygen to the carbon which has been oxidised to form copper and carbon dioxide.
    b. The copper was part of a compound, copper oxide before being reduced to its element. The copper ion, Cu^{2+}, has gained two electrons and therefore is reduced to copper, Cu.
7. The green compound is copper carbonate.
8. The copper in the statue has been oxidised to form copper carbonate.