B1 · Extra practice

Worked solutions | Items 1-2

Extra practice for this lesson. Original questions, not released diploma items. Select one option for multiple choice; other tasks state the required response.

Use the givens and conditions in each prompt. Enter the requested count, coefficient, oxidation number or potential with the stated unit and precision.

B1-D01 · Multiple choice

For the change $Fe^{3+} + e^- \rightarrow Fe^{2+}$, which statement is correct?

A. It is an oxidation, because the product is positive
B. It is a reduction, because an electron is gained
C. It is an oxidation, because the charge goes down
D. It is neither, because both particles are ions

1. Fe^{3+} gains one electron. Its charge goes down from +3 to +2, so B is correct.

2. A product can be positive and still be reduced. Reduction means gaining electrons.

B1-D02 · Multiple choice

Given $Zn + Cu^{2+} \rightarrow Zn^{2+} + Cu$, which reactant is the reducing agent?

A. Cu
B. Zn^{2+}
C. Cu^{2+}
D. Zn

1. Zn loses two electrons. Those electrons reduce Cu^{2+}. So D, Zn, is the reducing agent.

2. Zn^{2+} is a product. Cu^{2+} is the oxidizing agent, and Cu is its product.

B1 · Extra practice

Worked solutions | Items 3-4

B1-D03 · Numerical response

A neutral atom with 13 protons loses three electrons. How many electrons does it have now? Enter a whole number.

1. A neutral atom with 13 protons has 13 electrons. After losing three, it has 13 - 3 = 10.

2. It still has 13 protons. The ion has a charge of +3, but the question asks for the number of electrons.

B1-D04 · Select all that apply

Select every statement that is correct for $Mg + 2Ag^{+} \rightarrow Mg^{2+} + 2Ag$.

A. Mg is oxidized
B. Ag^{+} gains electrons
C. Mg^{2+} is the reducing agent
D. Each Mg atom gives two electrons

1. Choose A, B and D. Mg loses two electrons, and two Ag^{+} ions each gain one.

2. C names a product. The reducing agent is the reactant, Mg metal.

B1 · Extra practice

Worked solutions | Items 5-6

B1-D05 · Matching

Match each description to its redox word. Each word is used once.

Items to match:

1. Losing electrons
2. Gaining electrons
3. The reactant that lets its partner be reduced

Targets:

A. Reduction
B. Reducing agent
C. Oxidation

1. Losing electrons is oxidation. Gaining electrons is reduction. The reactant that lets its partner be reduced is the reducing agent.

2. An agent is named for what it does to its partner. What happens to the agent itself has the opposite name.

B1-D06 · Ordering / ranking

Put these actions in order for naming the agents in a reaction. Use each action once.

First to last

1. Name the reducing agent and the oxidizing agent
2. Follow each reactant to its product
3. Find which one loses electrons and which one gains them

1. Follow each reactant to its product. Find which loses and which gains electrons. Then name the agents from the reactants.

2. If you name the products first, you can get the wrong agent.

B1 · Extra practice

Worked solutions | Items 7-8

B1-D07 · Multiple choice

Which of these is not redox?

A. $Zn \rightarrow Zn^{2+} + 2e^-$

B. $Cu^{2+} + 2e^- \rightarrow Cu$

C. $KCl(s) \rightarrow K^+(aq) + Cl^-(aq)$

D. $2Na + Cl_2 \rightarrow 2NaCl$

1. C only separates ions that were already in the solid. K stays +1 and Cl stays -1.

2. In the other three, electrons are lost, gained, or moved from one neutral element to another.

B1-D08 · Numerical response

For $Zn \rightarrow Zn^{2+} + ne^-$, find n so that the charge balances. Enter a whole number.

1. The charge on the left is 0. The charge on the right is +2 - n. So 0 = 2 - n, and n = 2.

2. Count the negative charge of the electrons, even though a plus sign joins them to the products.

B1 · Extra practice

Worked solutions | Items 9-10

B1-D09 · Multiple choice

One aluminium atom loses three electrons. Three Ag^+ ions each gain one electron. Which net equation shows this?

A. $Al + Ag^+ \rightarrow Al^{3+} + Ag$

B. $Al + 3Ag^+ \rightarrow Al^{3+} + 3Ag$

C. $3Al + Ag^+ \rightarrow 3Al^{3+} + Ag$

D. $Al^{3+} + 3Ag \rightarrow Al + 3Ag^+$

1. B has one Al, which gives three electrons, and three Ag^+, which take one each. The charge is +3 on each side.

2. In A and C the electrons do not match. D is the reverse reaction.

B1-D10 · Written response

A student says every reaction that shows charged particles is redox. Give one example that proves the student wrong. Say which test shows it.

1. Use $KCl(s) \rightarrow K^+(aq) + Cl^-(aq)$. K and Cl were already +1 and -1 in the solid. They are the same after dissolving.

2. A redox reaction needs electrons to move. Compare each particle before and after. Charges in an equation are not enough.

B1 · Extra practice

Worked solutions | Items 11-12

B1-D11 · Multiple choice

For $Fe^{2+} + Ag^{+} \rightarrow Fe^{3+} + Ag$, which particle gives an electron and which takes it? Choose the pair in this order: reducing agent; oxidizing agent.

A. Fe^{3+}; Ag
B. Ag^{+}; Fe^{2+}
C. Fe^{2+}; Ag^{+}
D. Ag; Fe^{3+}

1. Fe^{2+} loses one electron and becomes Fe^{3+}. Ag^{+} takes it and becomes Ag. So C gives the two reactants in the right order.

2. Both reactants are positive. Fe^{2+} can still lose another electron.

B1-D12 · Select all that apply

Select every check that $Zn + 2Ag^{+} \rightarrow Zn^{2+} + 2Ag$ must pass to be a balanced net ionic equation.

A. One Zn and two Ag atoms on each side
B. The same total charge on both sides
C. Every particle on each side is neutral
D. Electrons lost equal electrons gained

1. A, B and D must be true. The charge is +2 on each side, and two electrons move.

2. C is false. Reactants and products can have charges, and the equal totals do not have to be zero.