Year 11 Science: Five reaction types in everyday contexts

Name: _____ Date: _____

Try these without your notes first, then check the answer key.

Practice

1. Name the reaction type: limestone heated in a kiln gives off a gas; two clear solutions are mixed and go cloudy; an iron gate turns orange-brown; lime is spread on an acidic paddock.

2. Write balanced equations for methane (CH_4) burning completely, and burning incompletely to make carbon monoxide.

3. Barium nitrate and sodium sulfate solutions are mixed. Name the precipitate, write the balanced equation, and name the spectator ions.

4. 50 g of calcium carbonate is heated until it has all decomposed. What mass of calcium oxide is left, and what mass of carbon dioxide escapes?

5. A gas heater with no flue is used in a closed bedroom. Discuss why this is dangerous, using combustion equations and conservation of mass.

6. Explain why an open bottle of fizzy drink gets lighter over an hour, but an unopened one does not.

Fix the mistake

7. Correct this statement: "Incomplete combustion makes less carbon dioxide because some of the carbon is destroyed."

8. Correct this statement: "A rusty nail weighs less because the rust has eaten some of the iron away."

9. Correct this statement: "When silver nitrate and sodium chloride are mixed, every ion forms the precipitate."

10. Correct this statement: "Fizzing always means neutralisation."

Answer key (for parents and tutors)

1. Name the reaction type: limestone heated in a kiln gives off a gas; two clear solutions are mixed and go cloudy; an iron gate turns orange-brown; lime is spread on an acidic paddock.
   Decomposition, precipitation, combination, neutralisation.

2. Write balanced equations for methane (CH_4) burning completely, and burning incompletely to make carbon monoxide.
   Complete: $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$. Incomplete: $2CH_4 + 3O_2 \rightarrow 2CO + 4H_2O$ (C 2, H 8, O 6 on each side).

3. Barium nitrate and sodium sulfate solutions are mixed. Name the precipitate, write the balanced equation, and name the spectator ions.
   Barium sulfate: $Ba(NO_3)_2 + Na_2SO_4 \rightarrow BaSO_4 + 2NaNO_3$; Na^+ and NO_3^- are spectators.

4. 50 g of calcium carbonate is heated until it has all decomposed. What mass of calcium oxide is left, and what mass of carbon dioxide escapes?
   $CaCO_3 \rightarrow CaO + CO_2$, and 100 g gives 56 g CaO and 44 g CO_2, so 50 g gives 28 g of calcium oxide and 22 g of carbon dioxide (28 + 22 = 50).

5. A gas heater with no flue is used in a closed bedroom. Discuss why this is dangerous, using combustion equations and conservation of mass.
   Achieved: methane burns in oxygen; with plenty of air, $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$. Merit: in a closed room the oxygen is used up, and with too little oxygen there are not enough O atoms to turn every C atom into CO_2, so $2CH_4 + 3O_2 \rightarrow 2CO + 4H_2O$ happens instead. Excellence: the carbon atoms cannot disappear, so as oxygen runs short more of them leave as carbon monoxide, which is colourless, odourless and poisonous, and water vapour builds up as well; opening a window or using a flued heater supplies oxygen for complete combustion.

6. Explain why an open bottle of fizzy drink gets lighter over an hour, but an unopened one does not.
   Carbonic acid decomposes, $H_2CO_3 \rightarrow H_2O + CO_2$, and in the open bottle the CO_2 gas escapes, taking its mass with it; in the sealed bottle every atom stays inside, so the mass is conserved.

7. Correct this statement: "Incomplete combustion makes less carbon dioxide because some of the carbon is destroyed."
   No carbon is destroyed; with too little oxygen some carbon atoms leave as carbon monoxide or soot instead of CO_2.

8. Correct this statement: "A rusty nail weighs less because the rust has eaten some of the iron away."
   Rust contains oxygen taken from the air, so the nail plus its rust weighs more than the clean nail did.

9. Correct this statement: "When silver nitrate and sodium chloride are mixed, every ion forms the precipitate."
   Only Ag^+ and Cl^- form solid AgCl; Na^+ and NO_3^- are spectator ions that stay dissolved.

10. Correct this statement: "Fizzing always means neutralisation."
    Fizzing just means a gas is made; a soft drink going flat is decomposition of carbonic acid, not a neutralisation.