Writing and Balancing Chemical Equations from Words

1. Combustion in automobile engines takes place when fuel and oxygen are combined and ignited in the cylinders of the engine. However, the air that provides the oxygen for combustion also introduces nitrogen into the engine. The nitrogen reacts with oxygen at the high temperatures present in the engine, producing nitrogen oxide compounds, which are a major component of smog. In one of these reactions, nitric oxide, NO, reacts with oxygen, O_2, to form nitrogen dioxide, NO_2. Write the balanced equation for this reaction.

Word equation

two nitric oxide molecules + 1 oxygen molecule = two nitrogen dioxide molecules

Formula equation

$2NO + O_2 \rightarrow 2NO_2$

2. During the centuries following the collapse of the western Roman Empire, marble (calcium carbonate, $CaCO_3$) was taken from the monuments of Rome and heated to form quicklime (calcium oxide, CaO), which was used to make plaster. Carbon dioxide, CO_2, was also produced in this decomposition reaction. Write the balanced equation for this reaction.

Word equation

one calcium carbonate unit decomposes into one calcium oxide unit and one carbon dioxide molecule

Formula equation

$CaCO_3 \rightarrow CaO + CO_2$

3. When a match is lit, sulfur (S_8) reacts with oxygen to release energy and form sulfur dioxide, SO_2. Write the balanced equation for this reaction.

Word equation

Formula equation

4. Zinc reacts with water to produce zinc hydroxide, $Zn(OH)_2$, and molecular hydrogen gas, H_2. Write the balanced equation for this reaction.

Word equation

Formula equation

5. Barium, Ba, reacts with sulfur, S_8, to form barium sulfide, BaS. Write the balanced equation for this synthesis reaction.

Word equation

Formula equation

LIVEWORKSHEETS

6. Automobile airbags rely on the decomposition of the compound sodium azide (NaN_3) to produce the nitrogen gas, N_2, needed to rapidly inflate the bag. Sodium is also produced in the reaction. Write the balanced equation for this decomposition reaction.

Word equation

_____

Formula equation

_____

7. A useful single-displacement reaction involves thermite, which is a mixture of aluminum and iron oxide, Fe_2O_3. When the thermite reaches a high temperature, the components react to produce molten iron, aluminum oxide (Al_2O_3), and a great deal of energy. Write the balanced equation for the thermite reaction.

Word equation

_____

Formula equation

_____

8. Acid indigestion can occur when the stomach produces too much hydrochloric acid, HCl. An old and effective remedy for this involves drinking a solution of baking soda (sodium hydrogen carbonate, $NaHCO_3$), which reacts with the hydrochloric acid to produce sodium chloride (NaCl), water, and carbon dioxide. Write the balanced equation for this reaction.

Word equation

_____

Formula equation

_____

9. A problem with the remedy given in problem 8 for acid indigestion is that the carbon dioxide produced can cause discomfort. In many modern antacids, the active ingredient is magnesium hydroxide, $Mg(OH)_2$. When this compound reacts with the hydrochloric acid, a double-displacement reaction occurs that produces only water and magnesium chloride, $MgCl_2$. Write the balanced equation for this reaction.

Word equation

_____

Formula equation

_____

10. Uranium reacts with fluorine gas, F_2, to form uranium(VI) fluoride, UF_6. Write the balanced equation for this synthesis reaction.

Word equation

_____

Formula equation

_____

LIVEWORKSHEETS

11. Iron reacts with chlorine gas, Cl_2, to form iron(III) chloride, $FeCl_3$. Write the balanced equation for this synthesis reaction.

Word equation

_____

Formula equation

_____

12. Aluminum sulfate, $Al_2(SO_4)_3$, decomposes to form aluminum oxide, Al_2O_3, and sulfur trioxide, SO_3. Write the balanced equation for this reaction.

Word equation

_____

Formula equation

_____

13. Water is decomposed by electrolysis to form the gaseous products hydrogen, H_2, and oxygen, O_2. Write the balanced equation for this reaction.

Word equation

_____

Formula equation

_____

14. Potassium chlorate, $KClO_3$, decomposes to form potassium chloride, KCl, and oxygen gas. Write the balanced equation for this decomposition reaction.

Word equation

_____

Formula equation

_____

15. Chlorine gas, Cl_2, reacts with potassium bromide, KBr, to form potassium chloride and bromine, Br_2. Write the balanced equation for this single-displacement reaction.

Word equation

_____

Formula equation

_____

16. Aluminum reacts with lead nitrate, $Pb(NO_3)_2$, to form lead and aluminum nitrate, $Al(NO_3)_3$. Write the balanced equation for this single-displacement reaction.

Word equation

_____

Formula equation

_____

LIVEWORKSHEETS

17. Ammonium chloride, NH_4Cl, reacts with calcium hydroxide, $Ca(OH)_2$, to form calcium chloride ($CaCl_2$), ammonia (NH_3), and water. Write the balanced equation for this reaction.

Word equation

_____

Formula equation

_____

18. Zinc reacts with hydrochloric acid, HCl, to form zinc chloride, $ZnCl_2$, and hydrogen gas. Write the balanced equation for this reaction.

Word equation

_____

Formula equation

_____

19. Fluorine reacts with sodium chloride, NaCl, to form sodium fluoride, NaF, and chlorine. Write the balanced equation for this single-displacement reaction. (**Hint:** Remember that both fluorine and chlorine have two atoms per molecule when they are in elemental form.)

Word equation

_____

Formula equation

_____

20. Calcium oxide, CaO, reacts with sulfur dioxide to form calcium sulfite, $CaSO_3$. Write the balanced equation for this synthesis reaction.

Word equation

_____

Formula equation

_____

21. In air, calcium sulfite, $CaSO_3$, reacts slowly with oxygen to form calcium sulfate, $CaSO_4$. Write the balanced equation for this reaction.

Word equation

_____

Formula equation

_____

LIVEWORKSHEETS

22. When heated, mercury(II) oxide, HgO, decomposes to form mercury and oxygen. Through this reaction, Joseph Priestley demonstrated the existence of oxygen in 1774. Write the balanced equation for the decomposition of mercury(II) oxide.

Word equation

_____

Formula equation

_____

23. Methanol, CH_3OH, decomposes to form carbon monoxide, CO, and hydrogen gas, H_2. Write the balanced equation for this decomposition reaction.

Word equation

_____

Formula equation

_____

24. Potassium nitrate, KNO_3, decomposes to form potassium nitrite, KNO_2, and oxygen gas, O_2. Write the balanced equation for this decomposition reaction.

Word equation

_____

Formula equation

_____

25. Antimony(V) chloride, $SbCl_5$, reacts with potassium iodide, KI, to form the products potassium chloride, KCl, iodine, I_2, and antimony(III) chloride, $SbCl_3$. Write the balanced equation for this reaction.

Word equation _____

Formula equation _____

26. Nitric acid, HNO_3, reacts with hydrogen sulfide, H_2S, to form nitrogen dioxide (NO_2), water, and sulfur (S). Write the balanced equation for this reaction.

Word equation

_____

Formula equation

_____

27. Chromium(III) oxide, Cr_2O_3, reacts with silicon to form chromium metal and silicon dioxide, SiO_2. Write the balanced equation for this reaction.

Word equation

_____

Formula equation

_____

LIVEWORKSHEETS

28. Ammonium dichromate, $(NH_4)_2Cr_2O_7$, decomposes to form chromium(III) oxide, Cr_2O_3, nitrogen gas, N_2, and water. Write the balanced equation for this decomposition reaction.

Word equation

_____

Formula equation

_____

29. Iron(II) chloride, $FeCl_2$, reacts with water at high temperatures to form triiron tetraoxide (Fe_3O_4), hydrochloric acid, and hydrogen gas. Write the balanced equation for this reaction.

Word equation

_____

Formula equation

_____

30. Aluminum sulfate, $Al_2(SO_4)_3$, reacts with calcium hydroxide, $Ca(OH)_2$, to form aluminum hydroxide, $Al(OH)_3$, and calcium sulfate, $CaSO_4$. Write the balanced equation for this double-displacement reaction.

Word equation

_____

Formula equation

_____

31. Lead chloride, $PbCl_2$, reacts with sodium chromate, Na_2CrO_4, to form lead chromate, $PbCrO_4$, and sodium chloride, NaCl. Write the balanced equation for this doubledisplacement reaction.

Word equation

_____

Formula equation

_____

32. Vanadium pentoxide, V_2O_5, reacts with calcium to form vanadium metal and calcium oxide, CaO. Write the balanced equation for this reaction.

Word equation

_____

Formula equation

_____

LIVEWORKSHEETS

33. When heated, tantalum metal reacts with chlorine gas to form tantalum pentachloride, $TaCl_5$. Write the balanced equation for this reaction.

Word equation

_____

Formula equation

_____

34. Potassium manganate(VI), K_2MnO_4, can be made to react with water, forming potassium permanganate, $KMnO_4$, potassium hydroxide, KOH, and hydrogen gas. This reaction is used in industry to produce potassium permanganate, which is widely used in analytical chemistry. Write the balanced equation for this reaction.

Word equation

_____

Formula equation

_____

35. Phosphorus pentoxide, P_4O_{10}, can be made to react with water (as steam) to form phosphoric acid, H_3PO_4. This reaction is an important industrial source of phosphoric acid. Write the balanced equation for this reaction.

Word equation

_____

Formula equation

_____

36. Iron sulfide, FeS, reacts with hydrochloric acid, HCl, to form hydrogen sulfide, H_2S, and iron(II) chloride, $FeCl_2$. Write the balanced equation for this reaction.

Word equation

_____

Formula equation

_____

LIVEWORKSHEETS