Chemical Reactions

1 Opaque box

2 Transparent box

3a Composition, total mass, colour, volume, and density
3b Number of pieces and shape
3c Colour and density
3d Volume, shape, and the number of pieces

4a Law of conservation of mass and atoms
4b Law of conservation of mass
4c None
4d Law of conservation of mass and atoms
4e None

5a ✗
5b ✓
5c ✗

6a Yes, the total number and kinds of atoms are equal on both sides. Therefore, mass must be equal as well.
6b Yes, the total number and kinds of atoms are equal on both sides. Therefore, mass must be equal as well.

7a $2\ Sn + O_2 \rightarrow 2\ SnO$
7b $H_2 + Cl_2 \rightarrow 2\ HCl$
7c $N_2 + 3\ H_2 \rightarrow 2\ NH_3$
7d $2\ Na + 2\ H_2O \rightarrow 2\ NaOH + H_2$
7e $4\ NH_3 + 3\ O_2 \rightarrow 2\ N_2 + 6\ H_2O$
7f $2\ C_6H_{14} + 19\ O_2 \rightarrow 12\ CO_2 + 14\ H_2O$
7g $2\ KNO_3 \rightarrow 2\ KNO_2 + O_2$
7h $CaC_2 + 2\ O_2 \rightarrow Ca + 2\ CO_2$
7i $C_5H_{12} + 8\ O_2 \rightarrow 5\ CO_2 + 6\ H_2O$
7j $K_2SO_4 + BaCl_2 \rightarrow 2\ KCl + BaSO_4$
7k $2\ KOH + H_2SO_4 \rightarrow K_2SO_4 + 2\ H_2O$
7l $Ca(OH)_2 + 2\ NH_4Cl \rightarrow 2\ NH_3 + CaCl_2 + 2\ H_2O$
7m $5\ C + 2\ SO_2 \rightarrow CS_2 + 4\ CO$
7n $Mg_3N_2 + 6\ H_2O \rightarrow 3\ Mg(OH)_2 + 2\ NH_3$
7o $V_2O_5 + 5\ Ca \rightarrow 5\ CaO + 2\ V$
7p $Na_2O_2 + H_2O \rightarrow 2\ NaOH + O_2$
7q $Fe_3O_4 + 4\ H_2 \rightarrow 3\ Fe + 4\ H_2O$
7r $Cu + 2\ H_2SO_4 \rightarrow CuSO_4 + 2\ H_2O + SO_2$

7s $2\ Al + 3\ H_2SO_4 \rightarrow 3\ H_2 + Al_2(SO_4)_3$
7t $2\ Si_4H_{10} + 13\ O_2 \rightarrow 8\ SiO_2 + 10\ H_2O$
7u $4\ NH_3 + O_2 \rightarrow 2\ N_2H_4 + 2\ H_2O$
7v $2\ C_{15}H_{30} + 45\ O_2 \rightarrow 30\ CO_2 + 30\ H_2O$
7w $2\ BN + 3\ F_2 \rightarrow N_2 + 2\ BF_3$
7x $CaSO_4 \cdot 2H_2O + 2\ SO_3 \rightarrow CaSO_4 + 2\ H_2SO_4$
7y $4\ C_3H_7N_2O_7 + 5\ O_2 \rightarrow 12\ CO_2 + 14\ H_2O + 4\ N_2$
7z $C_7H_{16}O_4S_2 + 11\ O_2 \rightarrow 7\ CO_2 + 8\ H_2O + 2\ SO_2$
7a1 $9\ Na + 4\ ZnI_2 \rightarrow 8\ NaI + NaZn_4$
7b1 $HBrO_3 + 5\ HBr \rightarrow 3\ Br_2 + 3\ H_2O$
7c1 $Al_4C_3 + 12\ H_2O \rightarrow 4\ Al(OH)_3 + 3\ CH_4$
7d1 $2\ Ca(NO_3)_2 \cdot 3H_2O + 3\ LaC_2 \rightarrow 2\ Ca(NO_3)_2 + 3\ La(OH)_2 + 3\ C_2H_2$
7e1 $CH_3NO_2 + 3\ Cl_2 \rightarrow CCl_3NO_2 + 3\ HCl$
7f1 $Ca_3(PO_4)_2 + 3\ SiO_2 + 5\ C \rightarrow 3\ CaSiO_3 + 5\ CO + 2\ P$
7g1 $Al_2C_6 + 6\ H_2O \rightarrow 2\ Al(OH)_3 + 3\ C_2H_2$
7h1 $2\ NaF + CaO + H_2O \rightarrow CaF_2 + 2\ NaOH$
7i1 $4\ LiH + AlCl_3 \rightarrow LiAlH_4 + 3\ LiCl$
7j1 $2\ CaF_2 + 2\ H_2SO_4 + SiO_2 \rightarrow 2\ CaSO_4 + SiF_4 + 2\ H_2O$
7k1 $3\ CaSi_2 + 2\ SbCl_3 \rightarrow 6\ Si + 2\ Sb + 3\ CaCl_2$
7l1 $2\ TiO_2 + B_4C + 3\ C \rightarrow 2\ TiB_2 + 4\ CO$
7m1 $4\ NH_3 + 5\ O_2 \rightarrow 4\ NO + 6\ H_2O$
7n1 $SiF_4 + 8\ NaOH \rightarrow Na_4SiO_4 + 4\ NaF + 4\ H_2O$
7o1 $2\ NH_4Cl + CaO \rightarrow 2\ NH_3 + CaCl_2 + H_2O$
7p1 $4\ NaPb + 4\ C_2H_5Cl \rightarrow Pb(C_2H_5)_4 + 3\ Pb + 4\ NaCl$
7q1 $Be_2C + 4\ H_2O \rightarrow 2\ Be(OH)_2 + CH_4$
7r1 $4\ NpF_3 + O_2 + 4\ HF \rightarrow 4\ NpF_4 + 2\ H_2O$
7s1 $3\ NO_2 + H_2O \rightarrow 2\ HNO_3 + NO$
7t1 $3\ LiAlH_4 + 4\ BF_3 \rightarrow 3\ LiF + 3\ AlF_3 + 2\ B_2H_6$

Solubility and Precipitates

1. Use a Table of Solubilities to predict whether or not the following compounds are soluble in water.
   CaI_2 – Yes
   $MgSO_4$ – Yes
   $AlPO_4$ – No
   $Pb(NO_3)_2$ – Yes
   Ag_2SO_4 – No
   $Ca(OH)_2$ – No

2. Write formulas and predict solubility.
   a. potassium phosphate – K_3PO_4 – Yes
   b. calcium carbonate – $CaCO_3$ – No
   c. copper (II) bromide – $CuBr_2$ – Yes
   d. aluminium sulphide – Al_2S_3 – No

3. Predict products, write balanced equations, and net ionic if precipitate forms.
   a. $Mg(NO_3)_2$ (aq) + 2 NaOH (aq) → $Mg(OH)_2$ (s) + 2 $NaNO_3$ (aq)

b. $CuSO_4$ (aq) + $FeCl_3$ (aq) → NR (no precipitate forms)

c. K_2CO_3 (aq) + $Sr(OH)_2$ (aq) → SrCO3 (s) + 2 KOH (aq)

4. Choose the ion that can selectively precipitate Pb^{2+} from Ba^{2+} and Ca^{2+}.
   Answer: S^{2-}

5.

In what order should the solutions Na2S, Na2CO3, and NaBr be added? NaBr, Na2S, Na2CO3

identify the three precipitates that form after the addition of those solutions. AgBr, CuS, CaCO3

which one cation will remain in solution? K +

Types of Chemical Reaction

SYN 1.) $8\ Fe\ (s) + S_8\ (s) \rightarrow 8\ FeS\ (s)$
SR 2.) $Zn\ (s) + Cu_2SO_4\ (aq) \rightarrow ZnSO_4\ (aq) + 2\ Cu\ (s)$
DR 3.) $AgNO_3\ (aq) + NaBr\ (aq) \rightarrow NaNO_3\ (aq) + AgBr\ (s)$
DR 4.) $FeCl_3\ (aq) + 3\ NH_4OH\ (aq) \rightarrow Fe(OH)_3\ (s) + 3\ NH_4Cl\ (aq)$
DECOMP 5.) $2\ H_2O\ (l) \rightarrow 2\ H_2\ (g) + O_2\ (g)$
DR 6.) $2\ KI\ (aq) + Pb(NO_3)_2\ (aq) \rightarrow PbI_2\ (s) + 2\ KNO_3\ (aq)$
DECOMP 7.) $2\ HgO\ (s) \rightarrow 2\ Hg\ (l) + O_2\ (g)$
SYN 8.) $4\ Al\ (s) + 3\ O_2\ (g) \rightarrow 2\ Al_2O_3\ (s)$
DR 9.) $MgCl_2\ (aq) + 2\ NH_4NO_3\ (aq) \rightarrow Mg(NO_3)_2\ (aq) + 2\ NH_4Cl\ (aq)$
DECOMP 10.) $2\ KClO_3\ (s) \rightarrow 2\ KCl\ (s) + 3\ O_2\ (g)$
MISC 11.) $2\ Na_2O_3\ (s) + 2\ H_2O\ (l) \rightarrow 4\ NaOH\ (aq) + O_2\ (g)$

Energy Changes in Chemical Reactions

1a.) Absorb
1b.) Give off
1c.) Step 2

2.) 432 kJ
Answer – The two reactions are the exact opposite of each other.

3.) Exothermic, as heat (energy) is produced.

4.) Endothermic, as heat (energy) is absorbed by the sugar to change phases.

5.) Losing energy.
Exothermic, as energy is released (lost).

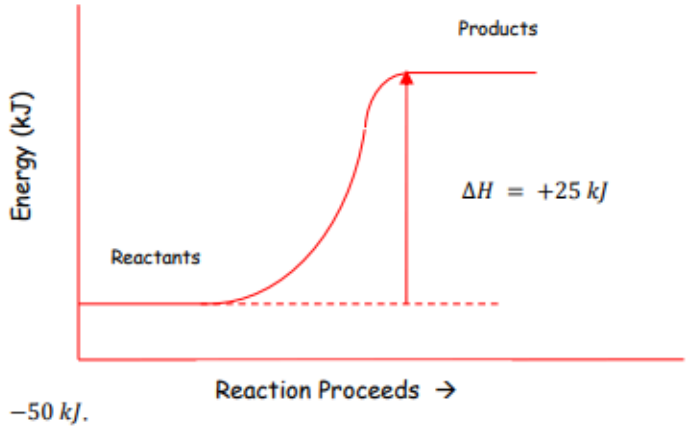
6.) Products
Answer – The reactants gain energy to become high energy products.

7.) Remove energy from reactants
Answer – Lower energy products are formed.

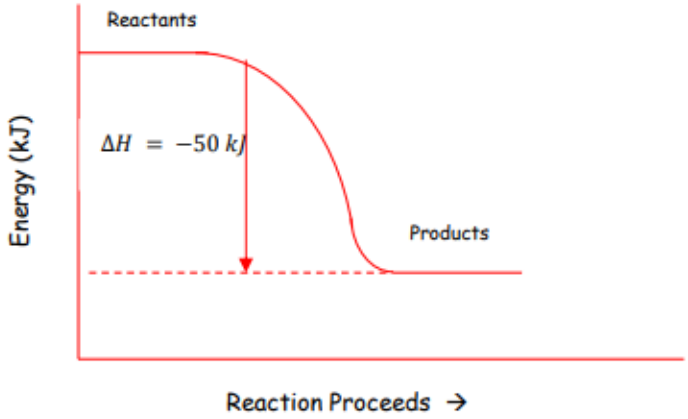
8a.) $\Delta H > 0$ for an endothermic reaction
Hreactants < Hproducts, so $\Delta H = Hp - Hr$ is positive

8b.) $\Delta H < 0$ for an exothermic reaction
Answer – Energy is released, so the enthalpy of products is less than that of reactants.

9.) Draw an energy diagram having $\Delta H = +25\ kJ$.



10.) Draw and energy diagram having $\Delta H = -50\ kJ$.



11. F-> G + 50 kJ

12. ΔH = +30 kJ

13. ΔH =-25 kJ, reactant has more energy