

Chapter 17 HW Answers

Review Questions:

5. Changing the subscript would change the molecule and that is not the goal. The goal is to determine how many grams of the molecule are needed or formed.

10. 1 mole marbles = 6×10^{23} marbles

11. 2 moles pennies = 12×10^{23} pennies = 1.2×10^{24} pennies

16. The reactions happen faster with increased temperature.

18. **Activation energy** is the minimum energy required for a reaction to proceed.

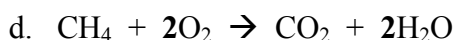
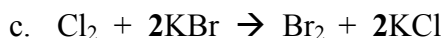
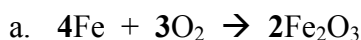
19. Chlorine destroys ozone.

21. A catalyst lowers the energy barrier of a reaction, lowers the activation energy.

24. **436 kJ** are released when the bond forms.

Exercises:

1.



3. **Yes**, the chemical equation shown is balanced.

4. **Yes**, the chemical equation shown is balanced.

5. The chemical equations in **a** and **c** are balanced.

13. First, we need to convert from grams to moles, and then determine the number of molecules for each.

$$17.031 \text{ grams NH}_3 \times \frac{1 \text{ mole}}{16.0228 \text{ grams}} \times \frac{6.02 \times 10^{23} \text{ molecules}}{1 \text{ mole}} = \mathbf{6.3988 \times 10^{23} \text{ molecules NH}_3}$$

$$72.922 \text{ grams HCl} \times \frac{1 \text{ mole}}{36.4609 \text{ grams}} \times \frac{6.02 \times 10^{23} \text{ molecules}}{1 \text{ mole}} = \mathbf{1.204 \times 10^{24} \text{ molecules HCl}}$$

There are more molecules of HCl.

14. Greatest number of molecules

$$28 \text{ grams N}_2 \times \frac{1 \text{ mole}}{28 \text{ grams}} \times \frac{6.02 \times 10^{23} \text{ molecules}}{1 \text{ mole}} = \mathbf{6.02 \times 10^{23} \text{ molecules N}_2}$$

$$32 \text{ grams O}_2 = \mathbf{6.02 \times 10^{23} \text{ molecules O}_2}$$

$$32 \text{ grams CH}_4 = \mathbf{1.2 \times 10^{24} \text{ molecules CH}_4} \quad \text{Greatest Number Molecules}$$

$$38 \text{ grams F}_2 = \mathbf{6.02 \times 10^{23} \text{ molecules F}_2}$$

15. $2 \text{ amu} \times \frac{1.661 \times 10^{-24} \text{ grams}}{1 \text{ amu}} = \mathbf{3.322 \times 10^{-24} \text{ grams}} \quad \text{(Mass of 2 H atoms)}$

22. Since there is the same number of molecules of each, the water (H₂O) molecules would have more mass than the hydrogen (H₂) molecules.

$$1.204 \times 10^{24} = 2 \text{ moles}$$

$$2 \text{ moles H}_2 \times \frac{2 \text{ grams}}{1 \text{ mole}} = \mathbf{4 \text{ grams H}_2}$$

$$2 \text{ moles H}_2\text{O} \times \frac{18 \text{ grams}}{1 \text{ mole}} = \mathbf{36 \text{ grams H}_2\text{O}}$$

29. Cooler temperatures slow down the reaction rates.

34. Nitrogen monoxide (**NO**) is the catalyst. The NO is the only molecule that reappears in the reaction as a product.

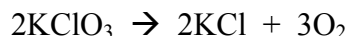
36. The **products** have the greater potential energy in an endothermic reaction.

37. The reactions of a battery are exothermic (batteries lose energy). Recharging a battery is an endothermic process; electricity (energy) is added to recharge the battery.

Problems:

2. $5.00 \text{ grams} \times \frac{1 \text{ mole}}{197 \text{ grams}} \times \frac{6.02 \times 10^{23} \text{ atoms}}{1 \text{ mole}} = \mathbf{1.5279 \times 10^{22} \text{ atoms}}$

5. First we need to determine the amounts shown by the chemical equation.

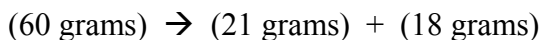
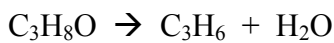


$$(245.10 \text{ grams}) \rightarrow (149.10 \text{ grams}) + (96 \text{ grams})$$

$$1 \text{ mole of KClO}_3 = 122.55 \text{ grams}$$

If only 122.55 grams of KClO₃ is provided, then only **48 grams** of O₂ will be produced.

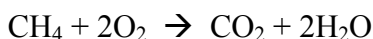
7. First we need to determine the amounts shown by the chemical equation.



Only 6 grams of reactant is provided ($1/10^{\text{th}}$).

If only 6 grams of $\text{C}_3\text{H}_8\text{O}$ is provided, then only **1.8 grams** of H_2O can be formed.

8. First we must determine the number of grams in 1 mole of CH_4 .



1 mole of $\text{CH}_4 = 16 \text{ grams}$

Since 16 grams are available, **2 moles** of water can be produced in the reaction.

2 moles $\text{H}_2\text{O} = \mathbf{36 \text{ grams H}_2\text{O}}$

9. $\text{H}_2 + \text{Cl}_2 \rightarrow 2\text{HCl}$

Draw the structures



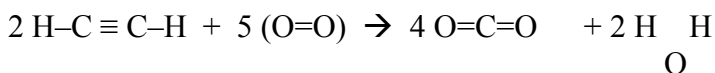
Add up the bond energies

1 mole H-H	+ 436 kJ (reactant)
1 mole Cl-Cl	+ 243 kJ (reactant)
2 mole H-Cl	- 862 kJ (product)

$\Delta E = -183 \text{ kJ}$ (Exothermic)

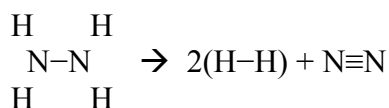
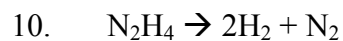
Now for the next reaction: $2 \text{HC} \equiv \text{CH} + 5\text{O}_2 \rightarrow 4\text{CO}_2 + 2\text{H}_2\text{O}$

Draw the structures



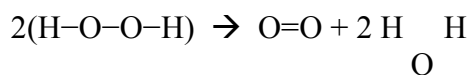
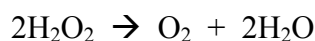
Add up the bond energies

4 moles H-C	+ 1656 kJ
2 mole C≡C	+ 1674 kJ
5 moles O=O	+ 2490 kJ
8 moles C=O	- 6424 kJ
4 moles H-O	- 1856 kJ
	- 2460 kJ (Exothermic)



4 moles H-N	+ 1556 kJ
1 mole N-N	+ 159 kJ
2 moles H-H	- 872 kJ
1 mole N≡N	<u>- 946 kJ</u>
	- 103 kJ (Exothermic)

Now for the next reaction



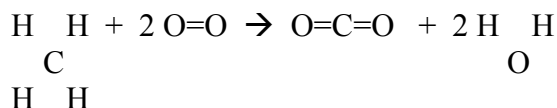
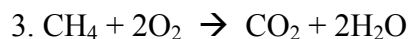
4 moles H-O	+ 1856 kJ
2 mole O-O	+ 276 kJ
1 mole O=O	- 498 kJ
4 moles H-O	<u>- 1856 kJ</u>
	- 222 kJ (Exothermic)

Additional:

1.
 - a. **12 grams** in 3 moles Helium
 - b. **132 grams** in 3 moles CO_2
 - c. **54 grams** in 3 moles H_2O
 - d. **540 grams** in 3 moles $\text{C}_6\text{H}_{12}\text{O}_6$

2. Same for each

$$3 \text{ moles} \times \frac{6.02 \times 10^{23}}{1 \text{ mole}} = \mathbf{18 \times 10^{23} \text{ atoms or molecules}}$$



4 moles H-C	+ 1656 kJ
2 moles O=O	+ 996 kJ
2 moles C=O	- 1606 kJ
4 moles H-O	<u>- 1856 kJ</u>
	- 810 kJ (Exothermic)

4. a) $2\text{Al} + 3\text{Cl}_2 \rightarrow 2\text{AlCl}_3$
b) $\text{SiO}_2 + 2\text{C} \rightarrow \text{Si} + 2\text{CO}$
c) $2\text{BF}_3 + 6\text{H}_2\text{O} \rightarrow 6\text{HF} + 2\text{H}_3\text{BO}_3$
d) $\text{NH}_4\text{NO}_3 \rightarrow \text{N}_2\text{O} + 2\text{H}_2\text{O}$

5. a. $\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + \text{O}_2$
b. $6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$
c. 540 grams

Extra Credit:

