

ANSWERS TO EXERCISES

1-2. potassium, K, 20 1-3. copper, Cu, 36 1-4. radon, Rn, 136 1-7. C₂H₄O₂
1-8. C₂H₅O₂N 1-9. C₆H₁₂O₄N₂S₂ 1-10. KBr 1-11. NH₄NO₃
1-12. Mg(NO₃)₂ 1-13. Al₂(SO₄)₃

2-2. $2\text{C}_6\text{H}_6 + 15\text{O}_2 \rightarrow 12\text{CO}_2 + 6\text{H}_2\text{O}$ 2-3. $\text{H}_2 + \text{Cl}_2 \rightarrow 2\text{HCl}$
2-4. $\text{CH}_4 + \text{H}_2\text{O} \rightarrow \text{CO} + 3\text{H}_2$ 2-5. $\text{Fe}_3\text{O}_4 + 4\text{C} \rightarrow 3\text{Fe} + 4\text{CO}$
2-6. $2\text{NO} + \text{O}_2 \rightarrow 2\text{NO}_2$ 2-7. $2\text{NaNO}_3 \rightarrow 2\text{NaNO}_2 + \text{O}_2$
2-8. $4\text{NH}_3 + 3\text{O}_2 \rightarrow 2\text{N}_2 + 6\text{H}_2\text{O}$ 2-9. $2\text{NH}_3 + 2\text{O}_2 \rightarrow \text{N}_2\text{O} + 3\text{H}_2\text{O}$
2-10. $\text{CO}_2 + \text{H}_2 \rightarrow \text{CO} + \text{H}_2\text{O}$
2-11. $\text{TI}^+(\text{aq}) + \text{F}^-(\text{aq}) \rightarrow \text{TIF}(\text{s})$
2-12. $\text{Cu}^{2+}(\text{aq}) + \text{CO}_3^{2-}(\text{aq}) \rightarrow \text{CuCO}_3(\text{s})$
2-13. $3\text{Ca}^{2+}(\text{aq}) + 2\text{PO}_4^{3-}(\text{aq}) \rightarrow \text{Ca}_3(\text{PO}_4)_2(\text{s})$

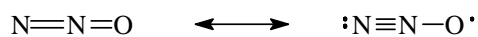
o1

6

5-8.

5-9.

5-10.



5-11.

5-12.

5-13.

5-14

5-15.

The non-bonding electrons on oxygen in answers to 5-16 - 5-18 are not shown.

5-16.

5-17.

5-18.

6-2. $\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}_3$ 6-3. $\text{CH}_3\text{CH}_2\text{CH}_2\text{C}/\text{CCH}_2\text{CH}_2\text{CH}_3$

In answers 6-4 - 6-9 below (=O) represents an oxygen atom bound by a double bond to the carbon atom immediately to its left. The structure of 6-4 showing all non C-C and C-H bonds is shown in the box for clarity.

6-4. $\text{CH}_3\text{C}(=\text{O})\text{CH}_2\text{CH}_2\text{CHBrCH}_2\text{CH}_3$ 6-5. $\text{NH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{C}(=\text{O})\text{H}$

6-6. $\text{CH}_3\text{CH}_2\text{C}(=\text{O})\text{OCH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$

6-7. $\text{CH}_3\text{CH}_2\text{CH}(\text{OH})\text{CH}_2\text{CH}(\text{CH}_2\text{CH}_2\text{CH}_3)\text{C}(=\text{O})\text{OH}$

6-8. $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{C}(=\text{O})\text{NH}_2$

6-9. $\text{HC}(=\text{O})\text{NHCH}_2\text{CH}_3$

6-10. (5-9) methanal 6-11. 1-chloropropane 6-12. propanone 6.13. propene

6.14. ethyl methyl peroxide 6-15. methyl ethanoate 6-16. 2-bromobutane

6-17. 3-hydroxypropanal 6-18. 2-chloro-4-fluorobutan-1,2-diol

7-2. $5.0 \times 10^{-2} \text{ m s}^{-1}$ 7-3. $6.4 \times 10^{11} \text{ N m}^{-2}$ 7-4. $2.8 \times 10^{-3} \text{ g L}^{-1}$ 7-6. $t = 2.3 \times 10^3 \text{ s}$

7-7. $p = 7.8 \times 10^{-5} \text{ Pa}$ 7-9. 300 K 7-10. $1.15 \times 10^5 \text{ s}$ 7-11. $8.13 \times 10^3 \text{ Pa}$

7-12. $5.45 \times 10^2 \text{ kg m}^{-3}$

8-2. 0.227 mol 8-3. 960 mol 8-4. 209 nmol 8-5. 540 g 8-6. 836 g 8-7. 1.79 g

8-8. 42 g 8-9. 17.4 kg 8-10. 306 t 8-11. 512 g

9-1. 32.5 L 9-2. 153 ng 9-3. 62 MPa 9-4. 168 kPa 9-5. 172 kPa

10-1. 200 g L^{-1} 0.584 mol L^{-1} 10-2. 0.486 g L^{-1} $8.36 \times 10^{-3} \text{ mol L}^{-1}$

10-3. 52.34 g L^{-1} $0.4151 \text{ mol L}^{-1}$ 10-4. $0.4483 \text{ mol L}^{-1}$ 10-5. 92.7

10.6 $c_f(\text{KIO}_3) = 0.02219 \text{ mol L}^{-1}$ $c(\text{Na}_2\text{S}_2\text{O}_3) = 0.1417 \text{ mol L}^{-1}$ $c(\text{Cl}_2) = 17.4 \text{ g L}^{-1}$

10-7. $6.03 \times 10^{-5} \text{ mol L}^{-1}$ 0.565 g

11-1. $4.184 \text{ J g}^{-1} \text{ K}^{-1}$ $1.00 \text{ cal g}^{-1} \text{ K}^{-1}$ $75.4 \text{ J mol}^{-1} \text{ K}^{-1}$

11-2. 43.0 kJ mol^{-1} 11-3. -298 kJ mol^{-1} 11-4.(i) $\text{CS}_2(\text{l}) + 3\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{SO}_2(\text{g})$

(ii) 90.0 kJ mol^{-1} 11-5. -101 kJ mol^{-1}

12-1. addition, reduction 12-2. decomposition, redox 12-3. addition, oxidation

12-4. elimination, acid-base 12-5. precipitation, redox 12-6. precipitation, redox 12-7. -3

12-8. +2 12-9. +6 12-10. H, +1 O, -1 12-11. +5 12-12. +6

12-13. $\text{Cl}_2 + 2\text{Fe}^{2+} \rightarrow 2\text{Cl}^- + 2\text{Fe}^{3+}$

12-14. $16\text{H}^+ + 2\text{MnO}_4^- + 10\text{Br}^- \rightarrow 2\text{Mn}^{2+} + 5\text{Br}_2 + 8\text{H}_2\text{O}$

12-15. $2\text{H}_2\text{O} + 2\text{MnO}_4^- + 3\text{Mn}^{2+} \rightarrow 5\text{MnO}_2 + 4\text{H}^+$

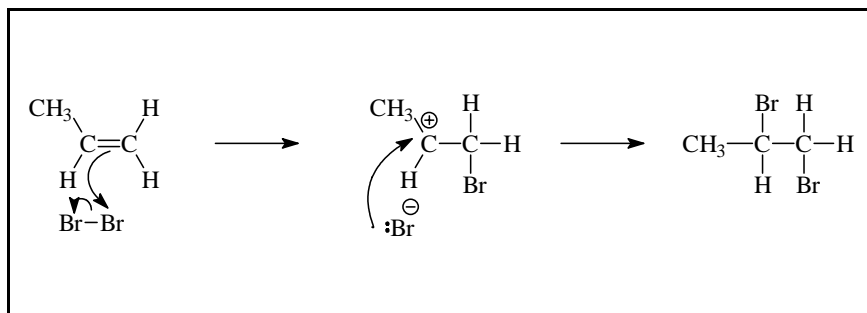
12-16. $\text{Zn} + \text{Fe}_2(\text{SO}_4)_3 \rightarrow \text{ZnSO}_4 + 2\text{FeSO}_4$

13-1. cuprous sulfate 13-2. ferric sulfate 13-3. phosphorous acid

15-1. O_2 15-2. Sn 15-3. $Zn|Zn^{2+}||Fe^{3+},Fe^{2+}|Pt$, 1.53 V 15-4. $Pt|Br_2,Br^-||I_2,I^-|Pt$, 0.56 V
 15-5. $Pt|Cl_2,Cl^-||Ag^+|Ag$, 0.60 V 15-6. Yes 15-7. No 15-8. No 15-9. Yes

16-1. (a) $1.0 \times 10^{-3} \text{ mol L}^{-1} \text{ s}^{-1}$ (b) $2.3 \times 10^{-5} \text{ mol L}^{-1} \text{ s}^{-1}$ 16-2. $2.5 \times 10^8 \text{ mol L}^{-1} \text{ s}^{-1}$

16-3.



Rate law: $rate = k[CH_3CH=CH_2][Br_2]$

16-4. Substitution, free radical