

66. a. neither - the oxidation states do not change
 b. neither - the oxidation states do not change
 c. reduction. The oxidation state of carbon decreases from +2 to -4.

68. a. 1,2,1,1,2
 b. 1,4,1,2,2
 c. 1,4,6,1,2,3
 d. 3,1,4,3,2,1
 e. 3,1,14,3,2,7

70. Oxidizing Agent Reducing Agent

- | | | |
|----|------------------------------|------------------|
| a. | NO_2 | CH_4 |
| b. | $\text{Ca}(\text{ClO})_2$ | HCl |
| c. | SeO_3^{2-} | I^- |
| d. | NO_3^- | Fe^{2+} |
| e. | $\text{Cr}_2\text{O}_7^{2-}$ | Zn |

71. a. Nothing is reduced
 b. Nothing is reduced

72. a. Nothing is oxidized
 b. Nothing is reduced

73. a. $\text{Zn}(\text{s}) + 2\text{H}^+(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + \text{H}_2(\text{g})$
 b. $\text{Cu}(\text{s}) + \text{Zn}^{2+}(\text{aq}) \rightarrow \text{No Reaction}$
 c. $\text{Fe}(\text{s}) + 2\text{Ag}^+(\text{aq}) \rightarrow \text{Fe}^{2+}(\text{aq}) + 2\text{Ag}(\text{s})$
 d. $\text{Au}(\text{s}) + \text{H}^+(\text{aq}) \rightarrow \text{No Reaction}$

74. The first and second reactions mean that M is not Cu, Ag, Hg, or Au, and it makes a 2^+ ion. The reaction with Fe^{2+} means that it is Mg, Al, Cr, or An. The reaction of Al metal with M ions means that M is below Al in the activity series. That leaves Cr or Zn, and since it does not react with the Zn^{2+} ion, M is Cr.