These problems are intended to ***supplement*** the problems in the textbook, not ***replace*** them.

Questions

What is the oxidation number of each atom in the following?

1. $KMnO_4$
2. NH_4^+
3. SbF_5
4. $SrCr_2O_7$
5. Mn_2O_3
6. $Cr_2(SO_4)_3$
7. Na_2CrO_4
8. $HC_2H_3O_2$
9. CO_3^{2-}
10. $H_4As_2O_7$

What is the oxidizing agent and what is the reducing agent in each of the following reactions?

11. $2\ Fe_2O_3(l) + 3\ C(s) \rightarrow 4\ Fe(l) + 3\ CO_2(g)$

12. $5\ Fe^{2+}(aq) + MnO_4^-(aq) + 8\ H^+(aq) \rightarrow 5\ Fe^{3+}(aq) + Mn^{2+}(aq) + 4\ H_2O(l)$

13. $HgO(s) + Zn(s) \rightarrow Hg(l) + ZnO(s)$

14. $2\ K_2Cr_2O_7(aq) + 3\ C_2H_5OH(aq) + 8\ H_2SO_4(aq)$
$\rightarrow\ 2\ Cr_2(SO_4)_3(aq) + 2\ K_2SO_4(aq) + 3\ HC_2H_3O_2(aq) + 11\ H_2O(l)$

15. $2\ NH_4^+(aq) + 2\ MnO_2(s) + Zn(s) \rightarrow Mn_2O_3(s) + 2\ NH_3(aq) + H_2O(l) + Zn^{2+}(aq)$

16. $2\ Cr_2O_3(s) + 3\ Si(s) \rightarrow 4\ Cr(s) + 3\ SiO_2(s)$

17. $6\ H^+(aq) + 5\ H_2C_2O_4(aq) + 2\ MnO_4^-(aq) \rightarrow 10\ CO_2(g) + 2\ Mn^{2+}(aq) + 8\ H_2O(l)$

18. $PbO_2(s) + 4\ Cl^-(aq) + 4\ H^+(aq) \rightarrow PbCl_2(s) + 2\ H_2O(l) + Cl_2(g)$

Complete and balance the following redox reactions which occur in acidic solution:

19. $Cr_2O_7^{2-}(aq) + I^-(aq) \rightarrow Cr^{3+}(aq) + I_2(s)$

20. $Mn^{2+}(aq) + NaBiO_3(s) \rightarrow Bi^{3+}(aq) + Na^+(aq) + MnO_4^-(aq)$

21. $As(s) + ClO_3^-(aq) \rightarrow H_3AsO_3(aq) + HClO(aq)$

22. $Fe^{2+}(aq) + HBrO_3(aq) \rightarrow Fe^{3+}(aq) + Br_2(l)$

23. $MnO_2(s) + SO_3^{2-}(aq) \rightarrow Mn^{2+}(aq) + S_2O_6^{2-}(aq)$

Complete and balance the following redox reactions which occur in basic solution:

24. $CN^-(aq) + MnO_4^-(aq) \rightarrow CNO^-(aq) + MnO_2(s)$

25. $NO_2^-(aq) + Al(s) \rightarrow NH_3(aq) + Al(OH)_4^-(aq)$

26. $Cr(OH)_3(s) + ClO^-(aq) \rightarrow CrO_4^{2-}(aq) + Cl_2(g)$

27. $H_2O_2(aq) + Cl_2O_7^{2-}(aq) \rightarrow ClO_2^-(aq) + O_2(g)$

28. $ClO_3^-(aq) + N_2H_4(g) \rightarrow NO(g) + Cl^-(aq)$

Answers

If you cannot figure out how to get the correct answer, go to your instructor, Science Tutoring Center, etc.

1. K is +1, O is –2, Mn is +7
2. H is +1, N is –3
3. F is –1, Sb is +5
4. Sr is +2, O is –2, Cr is +6
5. O is –2, Mn is +3
6. Cr is +3, O is –2, S is +6
7. Na is +1, O is –2, Cr is +6
8. H is +1, O is –2, C is 0
9. O is –2, C is +4
10. H is +1, O is –2, As is +5
11. ox agent is Fe_2O_3 and red agent is C
12. ox agent is MnO_4^- and red agent is Fe^{2+}
13. ox agent is HgO and red agent is Zn
14. ox agent is $K_2Cr_2O_7$ and red agent is C_2H_5OH
15. ox agent is MnO_2 and red agent is Zn
16. ox agent is Cr_2O_3 and red agent is Si
17. ox agent is MnO_4^- and red agent is $H_2C_2O_4$
18. ox agent is PbO_2 and red agent is Cl^-

19. $Cr_2O_7^{2-}(aq) + 6\ I^-(aq) + 14\ H^+(aq) \rightarrow 2\ Cr^{3+}(aq) + 3\ I_2(s) + 7\ H_2O(l)$

20. $2\ Mn^{2+}(aq) + 5\ NaBiO_3(s) + 14\ H^+(aq) \rightarrow 2\ MnO_4^-\ aq) + 5\ Bi^{3+}(aq) + 5\ Na^+(aq) + 7\ H_2O(l)$

21. $4\ As(s) + 3\ ClO_3^-(aq) + 6\ H_2O(l) + 3\ H^+(aq) \rightarrow 4\ H_3AsO_3(aq) + 3\ HClO(aq)$

22. $10\ Fe^{2+}(aq) + 2\ HBrO_3(aq) + 10\ H^+(aq) \rightarrow 10\ Fe^{3+}(aq) + Br_2(l) + 6\ H_2O(l)$

23. $MnO_2(s) + 2\ SO_3^{2-}(aq) + 4\ H^+(aq) \rightarrow Mn^{2+}(aq) + S_2O_6^{2-}(aq) + 2\ H_2O(l)$

24. $3\ CN^-(aq) + 2\ MnO_4^-(aq) + H_2O(l) \rightarrow 3\ CNO^-(aq) + 2\ MnO_2(s) + 2\ OH^-(aq)$

25. $NO_2^-(aq) + 2\ Al(s) + 5\ H_2O(l) + OH^-(aq) \rightarrow NH_3(aq) + 2\ Al(OH)_4^-(aq)$

26. $2\ Cr(OH)_3(s) + 6\ ClO^-(aq) \rightarrow 2\ CrO_4^{2-}(aq) + 3\ Cl_2(g) + 2\ H_2O(l) + 2\ OH^-(aq)$

27. $3\ H_2O_2(aq) + Cl_2O_7^{2-}(aq) \rightarrow 2\ ClO_2^-(aq) + 3\ O_2(g) + 3\ H_2O(l)$

28. $4\ ClO_3^-(aq) + 3\ N_2H_4(g) \rightarrow 4\ Cl^-(aq) + 6\ NO(g) + 6\ H_2O(l)$