NOW LET'S TRY A FEW HOMEWORK QUESTIONS:

1. In the reaction $2Al(s) + 3Cu^{2+}(aq) \rightarrow 2Al^{3+}(aq) + 3Cu(s)$, the Al(s)
   (1) gains protons (3) gains electrons
   (2) loses protons (4) loses electrons

2. Which change occurs when an Sn^{2+} ion is oxidized?
   (1) Two electrons are lost (3) Two protons are lost
   (2) Two electrons are gained (4) Two protons are gained

3. Given the reaction:
   $$Zn + 2HCl \rightarrow ZnCl_2 + H_2$$
   Which statement best describes what happens to the zinc?
   (1) The oxidation number changes from +2 to 0, and the zinc is reduced.
   (2) The oxidation number changes from 0 to +2, and the zinc is reduced.
   (3) The oxidation number changes from +2 to 0, and the zinc is oxidized.
   (4) The oxidation number changes from 0 to +2, and the zinc is oxidized.

4. When a substance is oxidized, it
   (1) loses protons (3) acts as an oxidizing agent
   (2) gains protons (4) acts as a reducing agent

5. Given the reaction:
   $$2Na + 2H_2O \rightarrow 2Na^+ + 2OH^- + H_2$$
   Which substance is oxidized?
   (1) H_2 (2) H^+ (3) Na (4) Na^+

6. Given the reaction:
   $$Zn(s) + 2HCl(aq) \rightarrow ZnCl_2(aq) + H_2(g)$$
   Which equation represents the correct oxidation half-reaction?
   (1) $Zn(s) \rightarrow Zn^{2+} + 2e^-$ (3) $Zn^{2+} + 2e \rightarrow Zn(s)$
   (2) $2H^+ + 2e^- \rightarrow H_2(g)$ (4) $2Cl^- \rightarrow Cl_2(g) + 2e^-$

7. In the reaction $4Zn + 10HNO_3 \rightarrow 4Zn(NO_3)_2 + NH_4NO_3 + 3H_2O$, the zinc is
   (1) reduced, and the oxidation number changes from 0 to +2
   (2) oxidized, and the oxidation number changes from 0 to +2
   (3) reduced, and the oxidation number changes from +2 to 0
   (4) oxidized, and the oxidation number changes from +2 to 0

8. In the reaction $2Al + 3Ni(NO_3)_2 \rightarrow 2Al(NO_3)_3 + 3Ni$, the aluminum is
   (1) reduced, and its oxidation number increases
   (2) reduced, and its oxidation number decreases
   (3) oxidized, and its oxidation number increases
   (4) oxidized, and its oxidation number decreases

9. In the reaction $Pb + 2Ag^+ \rightarrow Pb^{2+} + 2Ag$, the Ag^+ is
   (1) reduced, and the oxidation number changes from +1 to 0
   (2) reduced, and the oxidation number changes from +2 to 0
   (3) oxidized, and the oxidation number changes from 0 to +1
   (4) oxidized, and the oxidation number changes from +1 to 0

10. Which half-reaction correctly represents a reduction reaction?
    (1) $Sn^0 + 2e^- \rightarrow Sn^{2+}$ (3) $Li^0 + e^- \rightarrow Li^+$
    (2) $Na^0 + e^- \rightarrow Na^+$ (4) $Br_2^0 + 2e^- \rightarrow 2Br^-$

11. Which is the oxidizing agent in the reaction $2Fe^{2+} + Cl_2 \rightarrow 2Fe^{3+} + 2Cl^-$?
    (1) Fe^{2+} (2) Cl_2 (3) Fe^{3+} (4) Cl^-

12. In the reaction $2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$, the oxidizing agent is
    (1) H_2 (2) O_2 (3) H^+ (4) O^{2-}

13. In the reaction $Pb + 2Ag^+ \rightarrow Pb^{2+} + 2Ag$, the oxidizing agent is
    (1) Ag^+ (2) Ag (3) Pb (4) Pb^{2+}

14. In the reaction $2Mg + O_2 \rightarrow 2MgO$, the magnesium is the
    (1) oxidizing agent and is reduced
    (2) oxidizing agent and is oxidized
    (3) reducing agent and is reduced
    (4) reducing agent and is oxidized

15. Given the reaction:
    $$2KCl(\ell) \rightarrow 2K(s) + Cl_2(g)$$
    In this reaction, the K^+ ions are
    (1) reduced by losing electrons (3) oxidized by losing electrons
    (2) reduced by gaining electrons (4) oxidized by gaining electrons

16. Given the redox reaction:

$$2I^-(aq) + Br_2(\ell) \rightarrow 2Br^-(aq) + I_2(s)$$

What occurs during this reaction?
(1) The I^- ion is oxidized, and its oxidation number increases.
(2) The I^- ion is oxidized, and its oxidation number decreases.
(3) The I^- ion is reduced, and its oxidation number increases.
(4) The I^- ion is reduced, and its oxidation number decreases.

17. For a redox reaction to occur, there must be a transfer of
(1) protons (2) neutrons (3) electrons (4) ions

18. All redox reactions involve
(1) the gain of electrons, only (3) Both the gain and the loss of electrons
(2) the loss of electrons, only (4) neither the gain nor the loss of electrons

19. Given the redox reaction:

$$Fe^{2+}(aq) + Zn(s) \rightarrow Zn^{2+}(aq) + Fe(s)$$

Which species acts as a reducing agent?
(1) Fe(s) (2) $Fe^{2+}(aq)$ (3) Zn(s) (4) $Zn^{2+}(aq)$

20. In any oxidation-reduction reaction, the total number of electrons gained is
(1) less than the total number of electrons lost
(2) greater than the total number of electrons lost
(3) equal to the total number of electrons lost
(4) unrelated to the total number of electrons lost

21. A redox reaction is a reaction in which
(1) only reduction occurs
(2) only oxidation occurs
(3) reduction and oxidation occur at the same time
(4) reduction occurs first, and then oxidation occurs

22. In which substance is the oxidation number of nitrogen zero?
(1) N_2 (2) NH_3 (3) NO_2 (4) N_2O

23. Oxygen will have a positive oxidation number when combined with
(1) fluorine (2) chlorine (3) bromine (4) iodine

24. In which compound does chlorine have the highest oxidation number?
(1) KClO (2) $KClO_2$ (3) $KClO_3$ (4) $KClO_4$

25. What is the oxidation number of oxygen in HSO_4^-?
(1) +1 (2) −2 (3) +6 (4) −4

26. What is the oxidation number of carbon in $NaHCO_3$?
(1) +6 (2) +2 (3) −4 (4) +4

27. Oxygen has an oxidation number of −2 in
(1) O_2 (2) NO_2 (3) Na_2O_2 (4) OF_2

28. The oxidation number of nitrogen in N_2O is
(1) +1 (2) +2 (3) −1 (4) −2

29. What is the oxidation number of chlorine in $HClO_4$?
(1) +1 (2) +5 (3) +3 (4) +7

30. The oxidation number of nitrogen in N_2 is
(1) +1 (2) 0 (3) +3 (4) −3