1. Which expression correctly represents a balanced reduction half-reaction?

   A) $Na^+ + e^- \rightarrow Na$ B) $Na \rightarrow Na^+ + e^-$
   C) $Cl_2 + 2e^- \rightarrow Cl^-$ D) $2\ Cl^- \rightarrow Cl_2 + 2e^-$

2. Which half-reaction shows conservation of charge?

   A) $Cu + e^- \rightarrow Cu^+$ B) $Cu^{2+} + 2e^- \rightarrow Cu$
   C) $Cu^+ \rightarrow Cu + e^-$ D) $Cu^{2+} \rightarrow Cu + 2e^-$

3. Which equation shows conservation of charge?

   A) $Fe \rightarrow Fe^{2+} + e^-$ B) $Fe + 2e^- \rightarrow Fe^{2+}$
   C) $Fe \rightarrow Fe^{2+} + 2e^-$ D) $Fe + 2e^- \rightarrow Fe^{3+}$

4. When an equation is correctly balanced, it must show conservation of

   A) charge but not of mass
   B) mass but not of charge
   C) both charge and mass
   D) neither charge nor mass

5. A chemical reaction always demonstrates the conservation of what?

   A) temperature B) volume
   C) matter D) nothing

6. Which half-reaction for the reduction of Al^{3+} to Al is correctly balanced?

   A) $Al^{3+} + 3e^- \rightarrow Al$ B) $Al^{3+} + 3e^- \rightarrow 3\ Al$
   C) $Al^{3+} \rightarrow Al + 3e^-$ D) $Al^{3+} \rightarrow 3\ Al + 3e^-$

7. How many moles of electrons are needed to reduce 1 mole of Fe^{3+} to Fe^{2+}?

   A) 1 B) 2 C) 3 D) 5

8. In the reaction

   $$Ni + 2\ Ag^+ \rightarrow Ni^{2+} + 2\ Ag,$$

   what is the total number of moles of electrons lost by 1 mole of Ni?

   A) 1 B) 2 C) 0.5 D) 4

9. Compared to the amount of mass and total charge at the beginning of a redox reaction, the amount of mass and total charge upon completion of the reaction is

   A) less B) greater
   C) the same

10. Which half-reaction shows both the conservation of mass and the conservation of charge?

    A) $Cl_2 + 2e^- \rightarrow 2\ Cl$
    B) $Cl_2 \rightarrow Cl^- + 2e^-$
    C) $2\ Br^- + 2e^- \rightarrow Br_2$
    D) $Br^- \rightarrow Br_2 + 2e^-$

11. How many moles of electrons would be required to completely reduce 1.5 moles of Al^{3+} to Al?

    A) 0.50 B) 1.5 C) 3.0 D) 4.5

12. How many moles of electrons would be required to completely reduce 1.5 moles of Al^{3+} to Al?

    A) 0.50 B) 1.5 C) 3.0 D) 4.5

13. Which ionic equation is balanced?

    A) $Fe^{3+} + Al \rightarrow Fe^{2+} + Al^{3+}$
    B) $Fe^{3+} + 3Al \rightarrow Fe^{2+} + 3Al^{3+}$
    C) $3Fe^{3+} + Al \rightarrow 3Fe^{2+} + Al^{3+}$
    D) $3Fe^{3+} + Al \rightarrow Fe^{2+} + 3Al^{3+}$

14. Given the balanced equation representing a reaction:

    $$2Fe + 3Cu^{2+} \rightarrow 2Fe^{3+} + 3Cu$$

    When the iron atoms lose six moles of electrons, how many moles of electrons are gained by the copper ions?

    A) 12 moles B) 2 moles
    C) 3 moles D) 6 moles

15. Given the balanced equation:

    $$3\ Fe^{3+}(aq) + Al(s) \rightarrow 3\ Fe^{2+}(aq) + Al^{3+}(aq)$$

    What is the total number of moles of electrons lost by 2 moles of Al(s)?

    A) 1 mole B) 6 moles
    C) 3 moles D) 9 moles

16. Which redox equation is correctly balanced?

    A) $Cr(s) + 3\ Fe^{2+}(aq) \rightarrow 2\ Cr^{3+}(aq) + Fe(s)$
    B) $Pb(s) + 2\ H^+(aq) \rightarrow Pb^{2+}(aq) + H_2(g)$
    C) $Pb(s) + Ag^+(aq) \rightarrow Pb^{2+}(aq) + Ag(s)$
    D) $Zn(s) + Br_2(aq) \rightarrow Zn^{2+}(aq) + Br^-(aq)$

17. Given the reaction:

$$\_\_\ Cl_2(g) + \_\_\ Fe^{2+}(aq) \rightarrow \_\_\ Fe^{3+}(aq) + \_\_\ Cl^-(aq)$$

When the equation is correctly balanced using *smallest* whole numbers, the coefficient of $Cl^-(aq)$ will be

A) 1 B) 2 C) 6 D) 7

18. What is the coefficient of H^+ when the redox equation below is correctly balanced with whole number coefficients?

$$Cr_2O_7{}^{2-} + 6\,I^- + \_\_\ H^+ \rightarrow Cr^3 + H_2O + 3\,I_2$$

A) 14 B) 2 C) 7 D) 12

19. Given the unbalanced equation:

$$\_\_\ Fe + \_\_\ Ag^+ \rightarrow \_\_\ Ag + \_\_\ Fe^{3+}$$

When the equation is correctly balanced using smallest whole numbers, the coefficient of Ag^+ is

A) 5 B) 2 C) 3 D) 4

20. Given the reaction:

$$\_\_\ Cr + \_\_\ Fe^{2+} \rightarrow \_\_\ Cr^{3+} + \_\_\ Fe$$

When the reaction is completely balanced using the smallest whole number coefficients, the sum of the coefficients is

A) 10 B) 6 C) 3 D) 4