Chemistry

Standard level

Paper 1A

Practice paper

Topic: Redox Processes

Chemistry

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Specimen paper

45 minutes

Instructions to candidates

- Do not open this examination paper until instructed to do so.
- Answer all questions.
- For each question, choose the best answer.
- A clean copy of the chemistry data booklet is required.
- The maximum mark for this paper is [20 marks].

Section A

1. What is the oxidation state of chromium in the dichromate ion, $Cr_2O_7^{2-}$?
   A. +3
   B. +6
   C. +7
   D. +12

2. Which statement correctly defines oxidation?
   A. The gain of electrons and an increase in oxidation state.
   B. The loss of electrons and a decrease in oxidation state.
   C. The gain of electrons and a decrease in oxidation state.
   D. The loss of electrons and an increase in oxidation state.

3. In the reaction: $Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$, which species is the reducing agent?
   A. Zn(s)
   B. $Cu^{2+}(aq)$
   C. $Zn^{2+}(aq)$
   D. Cu(s)

4. Which of the following is a redox reaction?
   A. $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$
   B. $NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O(l)$
   C. $2Mg(s) + O_2(g) \rightarrow 2MgO(s)$
   D. $AgNO_3(aq) + NaCl(aq) \rightarrow AgCl(s) + NaNO_3(aq)$

5. What is the purpose of the salt bridge in a voltaic cell?
   A. To allow the flow of electrons between the half-cells.
   B. To prevent the flow of electrons between the half-cells.
   C. To allow the flow of ions to maintain electrical neutrality.
   D. To provide water for the solutions.

6. In the Winkler method, what is measured to determine the Biochemical Oxygen Demand (BOD) of a water sample?
   A. The volume of the water sample.
   B. The concentration of dissolved oxygen.
   C. The mass of the organic matter.
   D. The pH of the water.

7. Which of the following is a redox reaction?
A. Zinc reacting with hydrochloric acid
B. Neutralization of sodium hydroxide with sulfuric acid
C. Precipitation of silver chloride from silver nitrate and sodium chloride
D. Thermal decomposition of calcium carbonate

8. Which halogen is the strongest oxidizing agent?
A. F_2
B. Cl_2
C. Br_2
D. I_2

9. What is the correct half-equation for the reduction of the manganate(VII) ion, MnO_4^-, in acidic solution?
A. $MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$
B. $MnO_4^- + 4H_2O + 3e^- \rightarrow MnO_2 + 8OH^-$
C. $MnO_4^- + e^- \rightarrow MnO_4^{2-}$
D. $MnO_4^- + 8H^+ \rightarrow Mn^{2+} + 4H_2O + 5e^-$

10. Which metal will react with dilute hydrochloric acid to produce hydrogen gas?
A. Copper
B. Silver
C. Magnesium
D. Gold

11. What is the systematic IUPAC name for $FeCl_3$?
A. Iron chloride
B. Iron(II) chloride
C. Iron(III) chloride
D. Iron trichloride

12. Which statement regarding the reactivity series is correct?
A. Metals higher in the series are stronger oxidizing agents.
B. Metals lower in the series more readily lose electrons.
C. A metal higher in the series can displace a metal lower in the series from its salt solution.
D. A metal lower in the series can displace a metal higher in the series from its salt solution.

13. Which species can act as both an oxidizing agent and a reducing agent?
A. Na^+
B. F^-
C. H_2O_2
D. MnO_4^-

14. When balancing the equation $C_2O_4^{2-}$ -> CO_2, how many electrons are involved in the half-equation?
A. 1 electron on the left side.
B. 2 electrons on the left side.
C. 1 electron on the right side.
D. 2 electrons on the right side.

15. A sample of water is found to have a high BOD. What does this indicate?
A. The water is highly pure and oxygenated.
B. There is a low level of organic matter in the water.
C. There is a high level of organic matter degrading aerobically.
D. The water contains heavy metals.

16. Which of the following changes represent reduction?
I. Fe^{3+} -> Fe^{2+}
II. Cl_2 -> $2Cl^-$
III. SO_2 -> SO_3
A. I and II only
B. I and III only
C. II and III only
D. I, II and III

17. Which of the following combinations of reactants will result in a spontaneous redox reaction?
I. Magnesium metal and copper(II) sulfate solution
II. Copper metal and zinc sulfate solution
III. Zinc metal and silver nitrate solution
A. I and II only
B. I and III only
C. II and III only
D. I, II and III

18. Which observations indicate a spontaneous redox reaction occurs when a metal is placed in a salt solution?
I. A solid precipitate forms on the metal surface.

II. The color of the solution changes.
III. Heat is evolved.
A. I and II only
B. I and III only
C. II and III only
D. I, II and III

19. Which statements regarding oxidation states are correct?
I. The oxidation state of oxygen in peroxides is -1.
II. The oxidation state of hydrogen in metal hydrides is -1.
III. The sum of oxidation states in a polyatomic ion equals zero.
A. I and II only
B. I and III only
C. II and III only
D. I, II and III

20. Which features characterize a voltaic (Galvanic) cell?
I. It converts chemical energy into electrical energy.
II. The reaction is spontaneous.
III. The anode is positive.
A. I and II only
B. I and III only
C. II and III only
D. I, II and III