A-Level Chemistry

Redox

(Multiple Choice)

Question Paper

Time available: 32 minutes
Marks available: 30 marks

1. Which compound contains a chlorine atom with an oxidation state of +4?

A $KClO_4$ ⬭

B CCl_4 ⬭

C ClO_2 ⬭

D ClO_2F ⬭

(Total 1 mark)

2. Which equation does **not** show the reduction of a transition metal?

A $TiCl_4 + 2\ Mg \rightarrow Ti + 2\ MgCl_2$ ⬭

B $2\ FeCl_3 + 2\ KI \rightarrow 2\ FeCl_2 + 2\ KCl + I_2$ ⬭

C $MnO_2 + 4\ HCl \rightarrow MnCl_2 + Cl_2 + 2\ H_2O$ ⬭

D $CoO + 4\ HCl \rightarrow [CoCl_4]^{2-} + H_2O + 2\ H^+$ ⬭

(Total 1 mark)

3. NO_2^- ions can be reduced in acidic solution to NO How many electrons are gained when each NO_2^- ion is reduced?

A 1 ⬭

B 2 ⬭

C 3 ⬭

D 4 ⬭

(Total 1 mark)

4. Which compound contains chlorine in an oxidation state of +1?

A Cl_2O ⬭

B $KClO_3$ ⬭

C ClF_3 ⬭

D CCl_4 ⬭

(Total 1 mark)

5. In which conversion is the metal reduced?

A $Cr_2O_7^{2-} \rightarrow CrO_4^{2-}$ ⬭

B $MnO_4^{2-} \rightarrow MnO_4^{-}$ ⬭

C $TiO_2 \rightarrow TiO_3^{2-}$ ⬭

D $VO_3^{-} \rightarrow VO^{2+}$ ⬭

(Total 1 mark)

6. Which equation does **not** represent a redox reaction?

A $Mg + 2\ HCl \rightarrow MgCl_2 + H_2$ ⬭

B $CH_4 + 2\ O_2 \rightarrow CO_2 + 2\ H_2O$ ⬭

C $Fe + CuSO_4 \rightarrow FeSO_4 + Cu$ ⬭

D $CuO + 2\ HCl \rightarrow CuCl_2 + H_2O$ ⬭

(Total 1 mark)

7. Which of these is **not** a redox reaction?

A $Cu_2O + H_2SO_4 \longrightarrow CuSO_4 + Cu + H_2O$ ⬭

B $MgO + 2HCl \longrightarrow MgCl_2 + H_2O$ ⬭

C $SnCl_2 + HgCl_2 \longrightarrow Hg + SnCl_4$ ⬭

D $MnO_2 + 4HCl \longrightarrow MnCl_2 + 2H_2O + Cl_2$ ⬭

(Total 1 mark)

8. Which species is **not** produced by a redox reaction between solid sodium iodide and concentrated sulfuric acid?

A Na_2SO_4 ⬭

B H_2S ⬭

C S ⬭

D SO_2 ⬭

(Total 1 mark)

9. V_2O_5 can be used as a catalyst in the Contact Process.

Which is a step in the Contact Process in which the vanadium is oxidised?

A $SO_2 + V_2O_5 \longrightarrow SO_3 + 2VO_2$ ⬭

B $SO_3 + 2VO_2 \longrightarrow SO_2 + V_2O_5$ ⬭

C $2VO_2 + \frac{1}{2}O_2 \longrightarrow V_2O_5$ ⬭

D $V_2O_5 \longrightarrow 2VO_2 + \frac{1}{2}O_2$ ⬭

(Total 1 mark)

10. Which of these shows nitrogen in its correct oxidation states in the compounds given?

	NH_3	**N_2O**	**HNO_2**	
A	+3	−1	+5	⬭
B	−3	+1	+3	⬭
C	−3	+1	−5	⬭
D	+3	−1	−3	⬭

(Total 1 mark)

11. Which of these is a redox reaction?

A $CaO + SiO_2 \longrightarrow CaSiO_3$ ⬭

B $H_2SO_4 + Na_2O \longrightarrow Na_2SO_4 + H_2O$ ⬭

C $NaBr + H_2SO_4 \longrightarrow NaHSO_4 + HBr$ ⬭

D $Mg + S \longrightarrow MgS$ ⬭

(Total 1 mark)

12. Which of these species is the best reducing agent?

A Cl_2 ⬭

B Cl^- ⬭

C I_2 ⬭

D I^- ⬭

(Total 1 mark)

13. Which of the following shows chlorine in its correct oxidation states in the compounds shown?

	HCl	$KClO_3$	HClO	
A	−1	+3	+1	⬭
B	+1	−5	−1	⬭
C	−1	+5	+1	⬭
D	+1	+5	−1	⬭

(Total 1 mark)

14. Which substance is **not** produced in a redox reaction when solid sodium iodide reacts with concentrated sulfuric acid?

A H_2S ⬭

B HI ⬭

C SO_2 ⬭

D I_2 ⬭

(Total 1 mark)

15. In which reaction is hydrogen acting as an oxidising agent?

A $Cl_2 + H_2 \longrightarrow 2HCl$ ⬭

B $(CH_3)_2CO + H_2 \longrightarrow (CH_3)_2CHOH$ ⬭

C $N_2 + 3H_2 \longrightarrow 2NH_3$ ⬭

D $2Na + H_2 \longrightarrow 2NaH$ ⬭

(Total 1 mark)

16. In which reaction is the metal oxidised?

A $2Cu^{2+} + 4I^- \longrightarrow 2CuI + I_2$ ⬭

B $[Fe(H_2O)_6]^{3+} + Cl^- \longrightarrow [Fe(H_2O)_5(Cl)]^{2+} + H_2O$ ⬭

C $[CoCl_4]^{2-} + 6H_2O \longrightarrow [Co(H_2O)_6]^{2+} + 4Cl^-$ ⬭

D $Mg + S \longrightarrow MgS$ ⬭

(Total 1 mark)

17. Which species contains an element with an oxidation state of +4?

A NO_2^+ ⬭

B ClO_3^- ⬭

C H_2SO_3 ⬭

D PCl_5 ⬭

(Total 1 mark)

18. Refer to the unbalanced equation below when answering this question.

$$K_2Cr_2O7 + 3H_2C_2O_4 + \_H_2SO_4 \longrightarrow Cr_2(SO_4)_3 + \_H_2O + 6CO_2 + K_2SO_4$$

In the balanced equation the mole ratio for sulfuric acid to water is

A 1 : 4 ⬭

B 1 : 2 ⬭

C 4 : 7 ⬭

D 4 : 9 ⬭

(Total 1 mark)

19. Refer to the unbalanced equation below when answering this question.

$$K_2Cr_2O7 + 3H_2C_2O_4 + \_H_2SO_4 \longrightarrow Cr_2(SO_4)_3 + \_H_2O + 6CO_2 + K_2SO_4$$

What is the reducing agent in this reaction?

A H^+ ⬭

B $C_2O_4^{2-}$ ⬭

C K^+ ⬭

D $Cr_2O_7^{2-}$ ⬭

(Total 1 mark)

20. Which one of the following is the electron arrangement of the strongest reducing agent?

A $1s^2\ 2s^2\ 2p^5$

B $1s^2\ 2s^2\ 2p^6\ 3s^2$

C $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$

D $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2$

(Total 1 mark)

21. Which one of the following is **not** a redox reaction?

A $Br_2 + SO_2 + 2H_2O \rightarrow SO_4^{2-} + 4H^+ + 2Br^-$

B $SnCl_2 + HgCl_2 \rightarrow Hg + SnCl_4$

C $Cu_2O + H_2SO_4 \rightarrow CuSO_4 + Cu + H_2O$

D $2CrO_4^{2-} + 2H^+ \rightarrow Cr_2O_7^{2-} + H_2O$

(Total 1 mark)

22. Refer to the following reaction

$$H_2(g) + I_2(g) \rightleftharpoons 2HI(g) \qquad \Delta H^{\ominus} = -11\ kJ\ mol^{-1}, \qquad \Delta S^{\ominus} = +20\ J\ K^{-1}\ mol^{-1}$$

Which one of the following statements is correct?

A This is a redox reaction.

B The reaction is **not** feasible below 298 K

C At equilibrium, the yield of hydrogen iodide is changed by increasing the pressure.

D At equilibrium, the yield of hydrogen iodide increases as the temperature is increased.

(Total 1 mark)

23. Photochromic glass contains silver ions and copper ions. A simplified version of a redox equilibrium is shown below. In bright sunlight the high energy u.v. light causes silver atoms to form and the glass darkens. When the intensity of the light is reduced the reaction is reversed and the glass lightens.

$$Cu^{+}(s) + Ag^{+}(s) \rightleftharpoons Cu^{2+}(s) + Ag(s)$$

clear glass dark glass

When the photochromic glass darkens

A the Ag^{+} ion is acting as an electron donor.

B the Cu^{+} ion is acting as a reducing agent.

C the Ag^{+} ion is oxidised.

D the Cu^{+} ion is reduced.

(Total 1 mark)

24. Which one of the following statements is **not** correct?

A The first ionisation energy of iron is greater than its second ionisation energy.

B The magnitude of the lattice enthalpy of magnesium oxide is greater than that of barium oxide.

C The oxidation state of iron in $[Fe(CN)_6]^{3-}$ is greater than the oxidation state of copper in $[CuCl_2]^{-}$

D The boiling point of C_3H_8 is lower than that of CH_3CH_2OH

(Total 1 mark)

25. The vanadium does **not** have an oxidation state of +3 in

A $[V(H_2O)_6]^{3+}$

B $[V(C_2O_4)_3]^{3-}$

C $[V(OH)_3(H_2O)_3]$

D $[VCl_4]^{3-}$

(Total 1 mark)

26. In which one of the following reactions does hydrogen **not** act as a reducing agent?

A $H_2 + Ca \rightarrow CaH_2$

B $2H_2 + O_2 \rightarrow 2H_2O$

C $H_2 + CH_2{=}CH_2 \rightarrow CH_3CH_3$

C $2H_2 + CH_3COCH_3 \rightarrow CH_3CH_2CH_3 + H_2O$

(Total 1 mark)

27. In which one of the following reactions is the role of the reagent stated correctly?

	Reaction	**Role of reagent**
A	$TiO_2 + 2C + 2Cl_2 \rightarrow TiCl_4 + 2CO$	TiO_2 is an oxidising agent
B	$HNO_3 + H_2SO_4 \rightarrow H_2NO_3^+ + HSO_4^-$	HNO_3 is a Brønsted-Lowry acid
C	$CH_3COCl + AlCl_3 \rightarrow CH_3CO^+ + AlCl_4^-$	$AlCl_3$ is a Lewis base
D	$2CO + 2NO \rightarrow 2CO_2 + N_2$	CO is a reducing agent

(Total 1 mark)

28. Which one of the following is a redox reaction?

A $2CrO_4^{2-} + 2H^+ \rightarrow Cr_2O_7^{2-} + H_2O$

B $3Cl_2 + 6OH^- \rightarrow 5Cl^- + ClO_3^- + 3H_2O$

C $HNO_3 + 2H_2SO_4 \rightarrow NO_2^+ + H_3O^+ + 2HSO_4^-$

D $CaCO_3 + SiO_2 \rightarrow CaSiO_3 + CO_2$

(Total 1 mark)

29. In which of these substances is oxygen in the highest oxidation state?

A OF_2 ⬭

B H_2O ⬭

C O_2 ⬭

D H_2O_2 ⬭

(Total 1 mark)

30. In which one of the following reactions do two H ions and one electron have to be added to the left-hand side in order to balance the equation?

A $CH_3CHO \rightarrow CH_3CH_2OH$

B $VO^{2+} \rightarrow V^{3+} + H_2O$

C $NO_3^- \rightarrow HNO_2 + H_2O$

D $HOCl \rightarrow \frac{1}{2}Cl_2 + H_2O$

(Total 1 mark)