



EXAM PAPERS PRACTICE

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2002

XVIII

1583

Time allowed
26 Minutes

Score

/22

Percentage

%

CHEMISTRY

**AQA
AS & A LEVEL**

Topic Questions

3.1 Physical chemistry

1 Which one of the following contains the metal with the lowest oxidation state?

- A CrO_2F_2
- B $[\text{Cr}_2\text{O}_7]^{2-}$
- C $[\text{MnCl}_6]^{2-}$
- D $[\text{Mn}(\text{CN})_6]^{3-}$

(Total 1 mark)

2 In which one of the following reactions does the metal species undergo reduction?

- A $\text{MnO}_2 + 4\text{HCl} \rightarrow \text{MnCl}_2 + 2\text{H}_2\text{O} + \text{Cl}_2$
- B $[\text{Cu}(\text{H}_2\text{O})_6]^{2+} + 4\text{Cl}^- \rightarrow [\text{CuCl}_4]^{2-} + 6\text{H}_2\text{O}$
- C $\text{CrO}_7^{2-} + 2\text{OH}^- \rightarrow 2\text{CrO}_4^{2-} + \text{H}_2\text{O}$
- D $\text{TiO}_2 + 2\text{C} + 2\text{Cl}_2 \rightarrow \text{TiCl}_4 + 2\text{CO}$

(Total 1 mark)

3 The compound lithium tetrahydridoaluminate(III), LiAlH_4 , is a useful reducing agent. It behaves in a similar fashion to NaBH_4 . Carbonyl compounds and carboxylic acids are reduced to alcohols. However, LiAlH_4 also reduces water in a violent reaction so that it must be used in an organic solvent.

Which one of the following concerning the violent reaction between LiAlH_4 and water is **false**?

- A A gas is produced.
- B The activation energy for the reaction is relatively high.
- C The reaction has a negative free-energy change.
- D Aqueous lithium ions are formed.

(Total 1 mark)



4 Which one of the following is the electronic configuration 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)

5 Which equation does **not** involve the reduction of a transition metal compound?

- A $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$
- B $TiO_2 + 2C + 2Cl_2 \rightarrow TiCl_4 + 2CO$
- C $Cr_2O_3 + 2Al \rightarrow 2Cr + Al_2O_3$
- D $TiCl_4 + 4Na \rightarrow Ti + 4NaCl$

(Total 1 mark)

6 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)

7

In which one of the following reactions is H_2O_2 behaving as a reducing agent?

- A $\text{H}_2\text{O}_2 + 2\text{I}^- + 2\text{H}^+ \rightarrow \text{I}_2 + 2\text{H}_2\text{O}$
- B $\text{H}_2\text{O}_2 + 2[\text{Co}(\text{NH}_3)_6]^{2+} \rightarrow 2[\text{Co}(\text{NH}_3)_6]^{3+} + 2\text{OH}^-$
- C $5\text{H}_2\text{O}_2 + -2\text{MnO}_4^- + 6\text{H}^+ \rightarrow 2\text{Mn}^{2+} + 8\text{H}_2\text{O} + 5\text{O}_2$
- D $3\text{H}_2\text{O}_2 + 2[\text{Cr}(\text{OH})_6]^{3-} \rightarrow 2\text{CrO}_4^{2-} + 8\text{H}_2\text{O} + 2\text{OH}^-$

(Total 1 mark)

8

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

- A $\text{TiO}_2 + 2\text{Cl}_2 + \text{C} \rightarrow \text{TiCl}_4 + \text{CO}_2$
- B $\text{MnO}_2 + 4\text{HCl} \rightarrow \text{MnCl}_2 + 2\text{H}_2\text{O} + \text{Cl}_2$
- C $\text{MgO} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2\text{O}$
- D $3\text{MnO}_4^{2-} + 4\text{H}^+ \rightarrow 2\text{MnO}_4^- + \text{MnO}_2 + 2\text{H}_2\text{O}$

(Total 1 mark)

9

Which one of the following is a redox reaction?

- A $2\text{CrO}_4^{2-} + 2\text{H}^+ \rightarrow \text{Cr}_2\text{O}_7^{2-} + \text{H}_2\text{O}$
- B $3\text{Cl}_2 + 6\text{OH}^- \rightarrow 5\text{Cl}^- + \text{ClO}_3^- + 3\text{H}_2\text{O}$
- C $\text{HNO}_3 + 2\text{H}_2\text{SO}_4 \rightarrow \text{NO}_2^+ + \text{H}_3\text{O}^+ + 2\text{HSO}_4^-$
- D $\text{CaCO}_3 + \text{SiO}_2 \rightarrow \text{CaSiO}_3 + \text{CO}_2$

(Total 1 mark)

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

	Reaction	Role of reagent
A	$\text{TiO}_2 + 2\text{C} + 2\text{Cl}_2 \rightarrow \text{TiCl}_4 + 2\text{CO}$	TiO_2 is an oxidising agent
B	$\text{HNO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{H}_2\text{NO}_3^+ + \text{HSO}_4^-$	HNO_3 is a Brønsted-Lowry acid
C	$\text{CH}_3\text{COCl} + \text{AlCl}_3 \rightarrow \text{CH}_3\text{CO}^+ + \text{AlCl}_4^-$	AlCl_3 is a Lewis base
D	$2\text{CO} + 2\text{NO} \rightarrow 2\text{CO}_2 + \text{N}_2$	CO is a reducing agent

(Total 1 mark)

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

- A $\text{H}_2 + \text{Ca} \rightarrow \text{CaH}_2$
- B $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$
- C $\text{H}_2 + \text{CH}_2=\text{CH}_2 \rightarrow \text{CH}_3\text{CH}_3$
- C $2\text{H}_2 + \text{CH}_3\text{COCH}_3 \rightarrow \text{CH}_3\text{CH}_2\text{CH}_3 + \text{H}_2\text{O}$

(Total 1 mark)

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

- A $[\text{V}(\text{H}_2\text{O})_6]^{3+}$
- B $[\text{V}(\text{C}_2\text{O}_4)_3]^{3-}$
- C $[\text{V}(\text{OH})_3(\text{H}_2\text{O})_3]$
- D $[\text{VCl}_4]^{3-}$

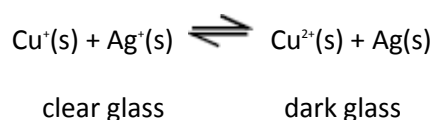
(Total 1 mark)

13 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 $[\text{Fe}(\text{CN})_6]^{3-}$ is greater than the oxidation state of copper in $[\text{CuCl}_2]^-$
- D The boiling point of C_3H_8 is lower than that of $\text{CH}_3\text{CH}_2\text{OH}$

(Total 1 mark)

14 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.



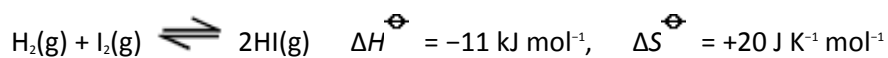
When the photochromic glass darkens

- 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)

15

Refer to the following reaction



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)

16

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

- A $\text{Br}_2 + \text{SO}_2 + 2\text{H}_2\text{O} \rightarrow \text{SO}_4^{2-} + 4\text{H}^+ + 2\text{Br}^-$
- B $\text{SnCl}_2 + \text{HgCl}_2 \rightarrow \text{Hg} + \text{SnCl}_4$
- C $\text{Cu}_2\text{O} + \text{H}_2\text{SO}_4 \rightarrow \text{CuSO}_4 + \text{Cu} + \text{H}_2\text{O}$
- D $2\text{CrO}_4^{2-} + 2\text{H}^+ \rightarrow \text{Cr}_2\text{O}_7^{2-} + \text{H}_2\text{O}$

(Total 1 mark)

17 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)

18 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 $Mg + S \longrightarrow MgS$

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(Total 1 mark)

19 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 $2Na + H_2 \longrightarrow 2NaH$

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(Total 1 mark)

20 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)

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

	HCl	KClO_3	HClO	
A	-1	+3	+1	<input type="checkbox"/>
B	+1	-5	-1	<input type="checkbox"/>
C	-1	+5	+1	<input type="checkbox"/>
D	+1	+5	-1	<input type="checkbox"/>

(Total 1 mark)

22 Which of these species is the best reducing agent?

A Cl_2 ☐

B Cl^- ☐

C I_2 ☐

D I^- ☐

(Total 1 mark)