UNIT 3 Sample Test

REDOX TEST

/52 marks

NAME:_____ TIME ALLOWED: 50 MINUTES

Part A: Multiple Choice Questions. (10 marks)

Q1. The sum of the Oxidation Numbers of the underlined elements of the following species is

$\underline{C}O_3^{2-}$ $\underline{K}H$ $H_2\underline{S}O_4$ $Mg(\underline{N}O_3)_2$

A) 11+
B) 13+
C) 15+
D) 16+

Q2. An Oxidising agent is one which

A) Contains Hydrogen atoms
B) Can donate electrons
C) Can accept electrons
D) Must contain an Oxygen atom

Q3 In the reaction below, which is true of Zinc ions?

$$Mg\ (s)\ +\ ZnCl_2\ (aq)\ \rightarrow\ MgCl_2\ (aq)\ +\ Zn\ (s)$$

A) It is oxidised by losing electrons
B) It is oxidised by gaining electrons
C) It is reduced by losing electrons
D) It is reduced by gaining electrons

Q4. Acidified Potassium Permanganate solution is a strong Oxidising agent because

A) the Mn in the compound has a high oxidation number which can be lowered by a reducing agent.
B) the K^+ ion in the compound can easily be reduced.
C) the compound has 4 Oxygen atoms.
D) the solution forms a precipitate of MnO_2 with a reducing agent.

Q5. Which one of the following is not a redox reaction?

A) $Cl_2 + 2KBr \rightarrow 2KCl + Br_2$
B) $Mg + CuSO_4 \rightarrow MgSO_4 + Cu$
C) $CuSO_4 + H_2S \rightarrow CuS + H_2SO_4$
D) $PbS + 4H_2O_2 \rightarrow PbSO_4 + 4H_2O$

Q6. Which of the following statements about oxidation numbers is false?

A) The oxidation number of a free element is Zero.
B) The oxidation number of a compound is Zero.
C) Cations always have positive oxidation numbers.
D) Non-metals always have negative oxidation numbers.

Q7. If a metal is found in its elemental form in nature, we expect that the metal

A) Is very reactive
B) Is very electropositive
C) Will form very stable compounds
D) To be completely pure

Q8. The Oxidation Numbers of element M in $Na_2H_2M_2O_7.6H_2O$ is

A) 0
B) +7
C) +5
D) +3

Q9. In the compound magnesium hydride, the oxidation numbers of the magnesium and the hydrogen are

	Oxidation number			
	A.	**B.**	**C.**	**D.**
Mg	+2	-2	-2	+2
H	-2	+2	+1	-1

Q10. Which of the following reactions shows that Hydrogen Peroxide is a reducing agent?

A) $H_2S + H_2O_2 \rightarrow S + 2H_2O$
B) $PbO_2 + H_2O_2 \rightarrow PbO + H_2O + O_2$
C) $H_2O_2 + dye \rightarrow H_2O + (dye + O)$
D) $H_2SO_3 + 4H_2O_2 \rightarrow H_2SO_4 + H_2O$

END OF PART A

PART B : SHORT ANSWER QUESTIONS (42 marks)

Q11. Several Redox reactions were carried out in the lab and some of the observations were recorded. From the information provided write one complete half equation for each experiment.

A) An unknown halogen was added to a colourless solution of iodide ions to form a brown solution.

Half-equation: _____

B) Aluminium metal was added to an unknown solution. The Aluminium dissolved producing a clear colourless solution.

Half-equation: _____

C) A metal was added to an unknown acid solution and a colourless gas was produced.

Half-equation: _____

[3 marks]

Q12. Identify the oxidising and reducing agents in each of the following:

[2 marks]

a) $Fe_2O_{3(s)} + 2CO_{(g)} \rightarrow 2Fe_{(s)} + 3CO_{2(g)}$

Oxidising agent: _____ Reducing agent: _____

a) $Cu_2O_{(s)} + 2H^+_{(aq)} \rightarrow Cu^{2+}_{(aq)} + Cu_{(s)} + H_2O_{(l)}$

Oxidising agent: _____ Reducing agent: _____

13. Consider the reaction:

$Mg_{(s)} + H_2O_{(l)} \rightarrow MgO_{(s)} + H_{2(g)}$

a. What substance is oxidised? To what?
b. What substance is reduced? To what?
c. What substance is the oxidant (oxidising agent)?
d. What substance is the reductant (reducing agent)?

(4 marks)

14. (a) Write the **two half equations**, the **overall reaction equation** and what you would **observe** if 5mL of a solution of potassium bromide is added to an aqueous solution of Chlorine (chlorine water). (4 marks)

(b) Write the **two half equations,** the **overall reaction equation** and what you would **observe** if 5 mL of acidified $K_2Cr_2O_7$ is added to an aqueous solution of $FeSO_4$ (iron (II) sulfate).

(4 marks)

15. What is the oxidation number of:

a. Cr in $K_2Cr_2O_7$
b. Mn in MnO_4^{1-}
c. N in NH_4^+
d. I in IO_3^-
e. S in $S_2O_3^{2-}$
f. P in HPO_4^{2-}
g. O in H_2O_2
h. Cl in HClO
i. N in N_2O_3
j. Xe in $HXeO_4^{1-}$

(5 marks)

16. Make two lists (1) oxidants and (2) reductants and classify the following into these two groups:

F_2, HClO, Zn, MnO_4^{-1}, Al, $Cr_2O_7^{-2}$, I^{-1}, Ag^+

(4 marks)

17. For each of the following changes, state whether it is oxidation, reduction or neither and give the change in oxidation state of the element involved.

a. $Cr(OH)_3 \rightarrow Cr_2O_7^{2-}$
b. $ClO^{-1} \rightarrow Cl^{-1}$
c. $MnO_2 \rightarrow Mn_2O_3$
d. $Cu_2S_{(s)} \rightarrow Cu_2O_{(s)}$

(8 marks)

18. Determine whether the following reactions represent SPONTANEOUS redox reactions or NOT. Be sure to justify your answer with working showing half equations with E^0 values, and the full equations with phases for any reactions that occur. Where a reaction is not spontaneous you must state this as well, and show your working to justify this conclusion.

a. Potassium metal added to water.
b. Copper filings added to dilute sulfuric acid.
c. Silver metal added to a solution of zinc nitrate.
d. Magnesium ribbon added to a solution of tin (II) sulfate.

(8 marks)

UNIT 3 Sample Test

REDOX TEST **52 marks**

NAME: Solutions **TIME ALLOWED: 55 MINUTES**

Part A: Multiple Choice Questions. (10 marks)

1	2	3	4	5	6	7	8	9	10
D	C	D	A	C	D	D	C	D	B

PART B : SHORT ANSWER QUESTIONS (10 marks)

Q11. Several Redox reactions were carried out in the lab and some of the observations were recorded. From the information provided write one complete half equation for each experiment.

D) An unknown halogen was added to a colourless solution of iodide ions to form a brown solution.

Half-equation: $2I^-_{(aq)} \rightarrow I_{2(aq)} + 2e^-_{(g)}$

E) Aluminium metal was added to an unknown solution. The Aluminium dissolved producing a clear colourless solution.

Half-equation: $Al_{(s)} \rightarrow Al^{3+}_{(aq)} + 3e^-$

F) A metal was added to an unknown acid solution and a colourless gas was produced.

Half-equation: $2H^+_{(aq)} + 2e^- \rightarrow H_{2(g)}$

[3 marks]

Q12. Identify the oxidising and reducing agents in each of the following:

[2 marks]

a) $Fe_2O_{3(s)} + 2CO_{(g)} \rightarrow 2Fe_{(s)} + 3CO_{2(g)}$

Oxidising agent: Fe_2O_3 Reducing agent: CO

13. $Cu_2O_{(s)} + 2H^+_{(aq)} \rightarrow Cu^{2+}_{(aq)} + Cu_{(s)} + H_2O_{(l)}$

Oxidising agent: Cu_2O Reducing agent: Cu_2O

13. a. $Mg \rightarrow Mg^{2+}$ or MgO (1 each)
b. $H_2O \rightarrow H_2$ (1 each)
c. H_2O (1 mark)
d. Mg (1 mark)

4 marks

14. (a) $Cl_2 + 2e^- \rightarrow 2Cl^{-1}$ (1 mark)
$2Br^{-1} \rightarrow Br_2 + 2e^-$ (1 mark)

$Cl_2 + 2Br^{-1} \rightarrow 2Cl^{-1} + Br_2$ (1 mark)

Obs: A clear colourless solution is added to a pale yellow solution. Upon addition the solution turns orange. (1 mark)

4 marks

(b) $Cr_2O_7^{-2} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$ (1 mark)

$6(Fe^{2+} \rightarrow Fe^{3+} + e^-)$ (1 mark)

$Cr_2O_7^{-2} + 6Fe^{2+} + 14H^+ \rightarrow 2Cr^{3+} + 6Fe^{3+} + 7H_2O$ (1 mark)

Obs: An orange coloured solution is added to a pale green solution. Upon addition a dark green solution is produced. (1 mark)

4 marks

15.

a.	Cr = +6	f.	P = +5
b.	Mn = +7	g.	O = -1
c.	N = -3	h.	Cl = +1
d.	I = +5	i.	N = +3
e.	S = +2	j.	Xe = +6

5 marks

16. 1. Oxididants = F_2, HClO, MnO_4^{-1}, $Cr_2O_7^{2-}$, Ag^+

2. Reductants = Zn, Al, I^{-1}

1/2 each x 8 = 4 marks

17.

a. $Cr(OH)_3 \rightarrow Cr_2O_7^{2-}$

(+3) (+6) Δ = +3 (1 mark) → Oxidation (½ mark)

b. $ClO^{-1} \rightarrow Cl^{-1}$

(+1) (-1) Δ = -2 (1 mark) → Reduction (½ mark)

c. $MnO_2 \rightarrow Mn_2O_3$

(+4) (+3) Δ = -1 (1 mark) → Reduction (½ mark)

d. $Cu_2S \rightarrow Cu_2O$

(+1) (+1) Δ = 0 (1 mark) → Neither (½ mark)

8 marks

18. a. $K_{(s)} + H_2O_{(l)}$

$2H_2O + 2e^- \rightarrow H_2 + 2OH^-$ E° = -0.83V (best reduction)

$K \rightarrow K^+ + e^-$ E° = +2.94V (best oxidation))

$2H_2O_{(l)} + 2K_{(s)} \rightarrow H_{2(g)} + 2KOH_{(aq)}$ E° = +2.11V

(1)

Positive E° value, therefore reaction is spontaneous. (1)

(2 marks total)

b. $Cu_{(s)} + 2H^+_{(aq)}$

$Cu \rightarrow Cu^{2+} + 2e^-$ E° = -0.34V (best oxidation)

$2H^+ + 2e^- \rightarrow H_2$ E° = +0.00V (best reduction)

$Cu_{(s)} + 2H^+_{(aq)} \rightarrow Cu^{2+}_{(aq)} + H_{2(g)}$ E° = -0.34V (1)

Negative E° value, therefore reaction NOT spontaneous. (1)

(2 marks total)

c. $Ag_{(s)} + Zn^{2+}_{(aq)}$

$Ag \rightarrow Ag^+ + e^-$ E° = -0.80V (best oxidation)

$Zn^{2+} + 2e^- \rightarrow Zn$ E° = -0.76V (best reduction)

$2Ag_{(s)} + Zn^{2+}_{(aq)} \rightarrow 2Ag^+_{(aq)} + Zn_{(l)}$ E° = -1.56V (1)

Negative E° value, therefore reaction is NOT spontaneous. (1)

(2 marks total)

d. $Mg_{(s)} + Sn^{2+}_{(aq)}$

$Mg \rightarrow Mg^{2+} + 2e^-$ E° = +2.36V (best oxidation)

$Sn^{2+} + 2e^- \rightarrow Sn$ E° = -0.14V (best reduction)

$Mg_{(s)} + Sn^{2+}_{(aq)} \rightarrow Mg^{2+}_{(aq)} + Sn_{(l)}$ E° = +2.22V (1)

Positive E° value, therefore reaction IS spontaneous. (1)

(2 marks total)