Name _____ Date _____

End of Chapter 20 test

This test and its sample answers have been written by the authors. IB may award marks differently.

1 In which substance does chlorine have the lowest oxidation number?

A $HClO_3$

B $[Co(NH_3)_6]Cl_3$

C ClO_2^-

D Cl_2

2 When the following redox equation is balanced using the smallest possible whole numbers, what is the sum of all the coefficients?

____ $Zn(s)$ + ____ $VO_3^-(aq)$ + ____ $H^+(aq) \rightarrow$ ____ $VO^{2+}(aq)$ + ____ $Zn^{2+}(aq)$ + ____ $H_2O(I)$

A 10

B 12

C 16

D 18

3 What is the oxidising agent in the following reaction?

$3C_2H_4O + Cr_2O_7^{2-} + 8H^+ \rightarrow 3C_2H_4O_2 + 2Cr^{3+} + 4H_2O$?

A H^+

B C_2H_4O

C $C_2H_4O_2$

D $Cr_2O_7^{2-}$

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

A $I_2 + 2Na_2S_2O_3 \rightarrow 2NaI + Na_2S_4O_6$

B $C_3H_6 + H_2 \rightarrow C_3H_8$

C $Pb(NO_3)_2 + 2KI \rightarrow PbI_2 + 2KNO_3$

D $6OH^- + 3Br_2 \rightarrow 5Br^- + BrO_3^- + 3H_2O$

5 Which of the following changes requires a reducing agent?

A $Cl^- \rightarrow ClO^-$

B $SO_4^{2-} \rightarrow SO_3^{2-}$

C $H_2O_2 \rightarrow O_2$

D $S_2O_3^{2-} \rightarrow S_4O_6^{2-}$

Use the following table of standard reduction potentials to answer questions **6**–**11**.

	$E°$ / V
$Na^+(aq) + e^- \rightleftharpoons Na(s)$	−2.71
$Zn^{2+}(aq) + 2e^- \rightleftharpoons Zn(s)$	−0.76
$Cr^{3+}(aq) + 3e^- \rightleftharpoons Cr(s)$	−0.74
$Fe^{2+}(aq) + 2e^- \rightleftharpoons Fe(s)$	−0.45
$2H^+(aq) + 2e^- \rightleftharpoons H_2(g)$	0.00
$Cu^{2+}(aq) + 2e^- \rightleftharpoons Cu(s)$	+0.34
$Cu^+(aq) + e^- \rightleftharpoons Cu(s)$	+0.52
$I_2(aq) + 2e^- \rightleftharpoons 2I^-(aq)$	+0.54
$Fe^{3+}(aq) + e^- \rightleftharpoons Fe^{2+}(s)$	+0.77
$Ag^+(aq) + e^- \rightleftharpoons Ag(s)$	+0.80
$Cl_2(aq) + 2e^- \rightleftharpoons 2Cl^-(aq)$	+1.36

6 Which species in the table is the strongest oxidising agent?

A Cl_2

B Na^+

C Cl^-

D Na

7 Which two species in the table can reduce Fe^{2+} to Fe?

A Cr and H_2

B Na and Zn

C Cl^- and Ag

D I^- and Cr

8 Which species in the table can oxidise Cu to Cu^{2+} but not Cl^- to Cl_2?

A Cr^{3+}

B Fe^{2+}

C H^+

D Fe^{3+}

9 What is the standard cell potential for the following equation?

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

A +0.28 V

B +0.46 V

C +1.14 V

D +1.26 V

10 For the following reaction, what is its $\Delta G^\ominus$ value?

$Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$

The value of the Faraday constant is 96 500 C mol^{-1} and $\Delta G^\ominus = -nFE^\ominus$

A −247 kJ mol^{-1}

B −212 kJ mol^{-1}

C −106 kJ mol^{-1}

D +106 kJ mol^{-1}

11 In the voltaic cell $Zn(s)|Zn^{2+}(aq)||Fe^{3+}(aq),Fe^{2+}(aq)|Pt(s)$, which of the following is correct?

A Zn^{2+} is reduced and Fe^{2+} is oxidised.

B Electrons flow from the Zn/Zn^{2+} half-cell to the Fe^{3+}/Fe^{2+} half-cell.

C The half-cell $Fe^{3+}(aq)/Fe^{2+}(aq)$ is the anode of the voltaic cell.

D Zn^{2+} is a stronger oxidizing agent than Fe^{3+}.

12 What is the vanadium species present in the reaction mixture when an excess of Zn powder is added to an acidified solution containing $VO_2^+(aq)$ ions?

$VO_2^+(aq) + 2H^+(aq) + e^- \rightleftharpoons VO^{2+}(aq) + H_2O(l)$ $E = +1.00$ V

$VO^{2+}(aq) + 2H^+(aq) + e^- \rightleftharpoons V^{3+}(aq) + H_2O(l)$ $E = +0.36$ V

$V^{3+}(aq) + e^- \rightleftharpoons V^{2+}(aq)$ $E = -0.26$ V

$Zn^{2+}(aq) + 2e^- \rightleftharpoons Zn(s)$ $E = -0.76$ V

A $V^{2+}(aq)$

B $V^{3+}(aq)$

C $VO^{2+}(aq)$

D $VO_2^+(aq)$

13 In the electrolysis of acidified water, which of the following statements is true?

A H_2 is produced at the anode and O_2 is produced at the cathode.

B H_2 and O_2 are produced in a mole ratio of 1 : 2.

C H_2 and O_2 are produced in a mole ratio of 1 : 1.

D H_2 and O_2 are produced in a mole ratio of 2 : 1.

14 A spoon is being electroplated with silver. Which of the following statements are correct?

I The spoon should be the negative electrode.

II Silver chloride is a suitable electrolyte for this process.

III The anode is made of silver.

A **III** only

B **I** and **II** only

C **I** and **III** only

D **I**, **II** and **III**

15 Butane-1,2-diol can be oxidised using acidified potassium dichromate(VI).
Which of the following products could be formed?

I $CH_3CH_2CH(OH)CHO$

II $CH_3CH_2COCH_2OH$

III $CH_3CH_2COCOOH$

A **III** only

B **I** and **II** only

C **I** and **III** only

D **I**, **II** and **III**

END OF TEST