

**GERT SIBANDE DISTRICT  
MSTA SUB HUB**

**GRADE 12**

**PHYSICAL SCIENCES TOPIC TEST  
TOPIC: ELECTROCHEMICAL REACTIONS  
JULY 2022  
QUESTION PAPER**

*Stanmorephysics.com*

**MARKS: 50**

**TIME: 1:00HOUR**

**This question paper consists of 9 pages including the data sheets**

## INSTRUCTIONS

1. Attempt ALL questions
2. Round off your final answers to a minimum of TWO decimal places.
3. You're advised to use the attached data sheet.
4. Write neatly and legibly.

## QUESTION 1

Four options (A – D) are given as possible answers to the following questions. Choose the answer and write only the letter (A – D) next to the question number (1.1 – 1.3).

- 1.1 Consider the reaction represented by the balanced equation below:

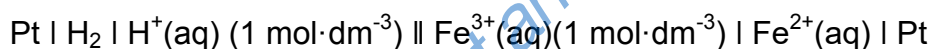


In the above reaction,  $\text{Cu}_{(s)}$  is the ...

- A oxidising agent and is reduced.
- B oxidising agent and is oxidized.
- C reducing agent and is reduced.
- D reducing agent and is oxidized.

(2)

- 1.2 Consider the electrochemical cell with the following cell notation:

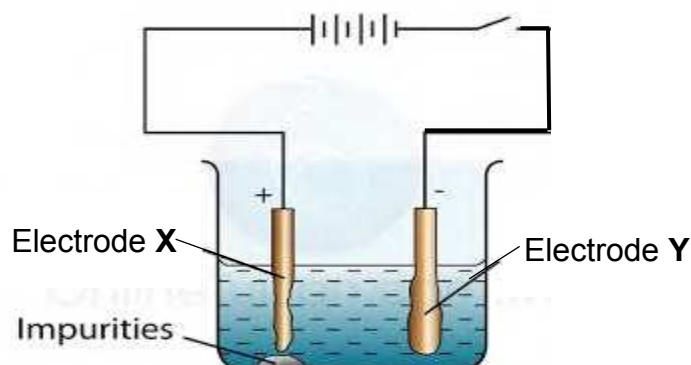


Which ONE of the following equations represents the cathode half-cell reaction?

- A  $\text{Fe}^{3+}(\text{aq}) + \text{e}^- \rightarrow \text{Fe}^{2+}(\text{aq})$
- B  $\text{Fe}^{2+}(\text{aq}) \rightarrow \text{Fe}^{3+}(\text{aq}) + \text{e}^-$
- C  $\text{H}_2(\text{g}) \rightarrow 2\text{H}^+(\text{aq}) + 2\text{e}^-$
- D  $2\text{H}^+(\text{aq}) + 2\text{e}^- \rightarrow \text{H}_2(\text{g})$

(2)

- 1.3 The simplified diagram below shows the experimental set-up used to purify copper.



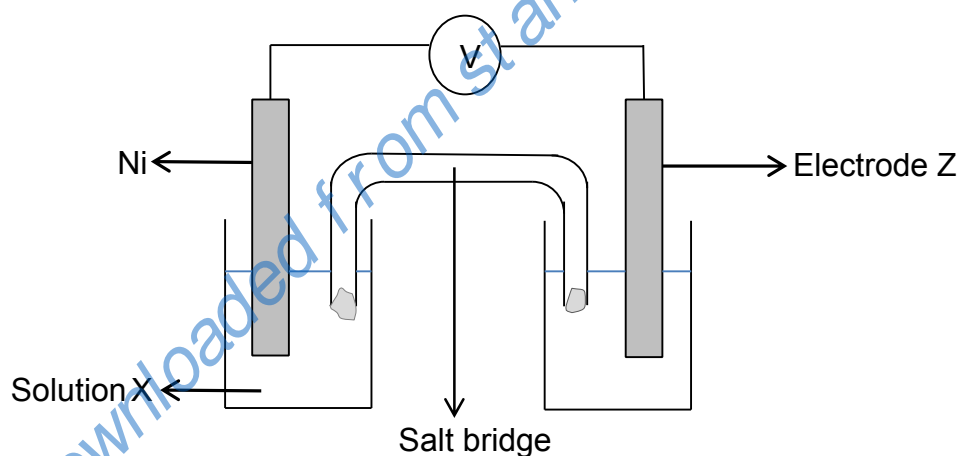
Which ONE of the following is CORRECT?

	<b>ELECTRODE X</b>	<b>ELECTRODE Y</b>	<b>ELECTROLYTE</b>
A	Pure Copper	Impure copper	$\text{CuSO}_4$
B	Impure copper	Impure copper	$\text{NiO}_4$
C	Pure Copper	Pure Copper	$\text{NiSO}_4$
D	Impure copper	Pure copper	$\text{CuSO}_4$

(2)  
[6]

## QUESTION 2

A standard electrochemical cell is set up using nickel (Ni) and electrode Z as shown in the diagram below.



- 2.1 When this cell is operated under standard conditions, nickel electrode decreases in mass and the cell potential is found to be 1,07 V. Write down:

- 2.1.1 The energy conversion that takes place in this cell. (1)
- 2.1.2 ONE standard condition required for the cell operation (1)
- 2.2.3 ONE function of the salt bridge. (1)
- 2.1.4 The NAME or FORMULA of solution X. (1)

2.1.5 The oxidation half reaction for this cell. (2)

2.2 Use a calculation to show that electrode **Z** is silver. (4)

2.3 At which half-cell, **Ni** or **Z**, are electrons released into the external circuit? (1)  
[11]

### QUESTION 3

3.1 The cell notation of a galvanic cell is written below.  
 $\text{Mg(s)} \mid \text{Mg}^{2+}(\text{aq}) (1\text{mol.dm}^{-3}) \parallel \text{Co}^{2+}(\text{aq}) (1\text{mol.dm}^{-3}) \mid \text{Co(s)}$

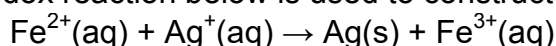
3.1.1 Define oxidising agent in terms of electron transfer. (2)

3.1.2 What does the double line(II) represent? (1)

3.1.3 Write down the FORMULA of the substance which is oxidising agent. (1)

3.1.4 Calculate the initial emf of this cell under standard conditions. (3)

3.2 The redox reaction below is used to construct an electrochemical cell.



3.2.1 Define oxidation in terms of oxidation number. (2)

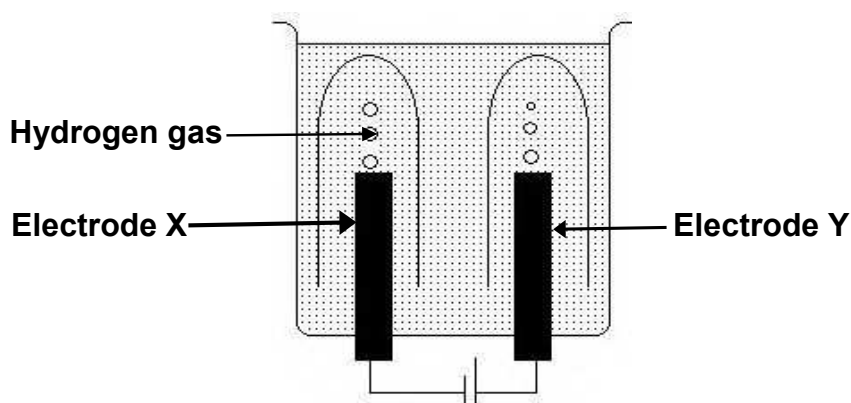
3.2.2 Name a substance that should be used as electrode in the anode half-cell (1)

3.2.3 Write down the NAME or FORMULA of the oxidizing agent. (1)

3.2.4 Write down the cell notation of the cell. (3)  
[14]

### QUESTION 4

The diagram below shows the electrolysis of concentrated sodium chloride solution using graphite electrodes.

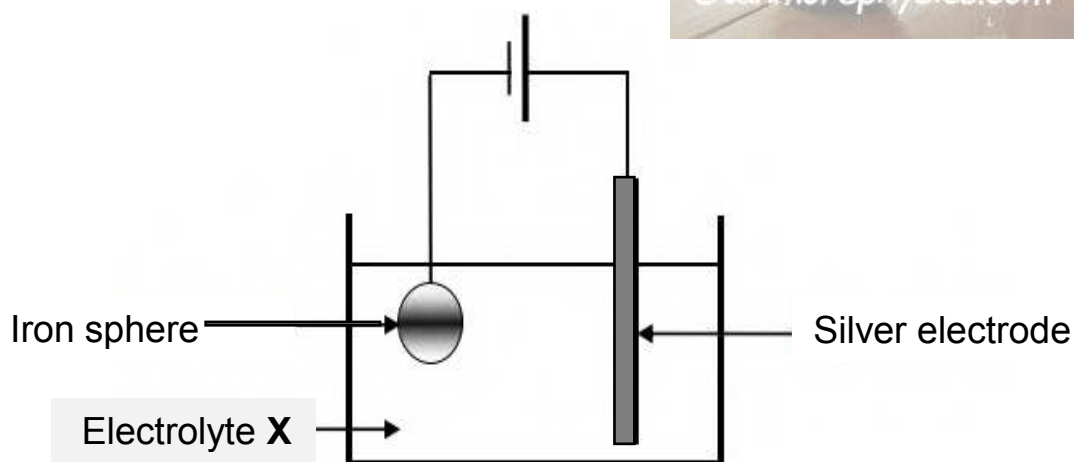


- 4.1 Define the term electrolysis. (2)
- 4.2 Is the reaction in this cell EXOTHERMIC or ENDOTHERMIC? (1)
- 4.3 Give ONE reason why graphite is used as electrodes in this cell. (1)
- 4.4 Write down:
- 4.4.1 The FORMULA of the electrolyte used in this cell. (1)
- 4.4.2 The half reaction to show how hydrogen gas is formed at electrode **X**. (2)
- 4.4.3 The half reaction that occurs at the electrode **Y**. (2)
- 4.5 Refer to the Table of Standard Reduction Potentials to explain why hydrogen gas, and not sodium, is formed at electrode **X**. (2)
- 4.6 Give a reason why at the end of the reaction, the solution in the cell is alkaline(basic). (1)

[12]

### QUESTION 5

The simplified diagram below represents an electrolytic cell used to electroplate iron (Fe) sphere with silver (Ag).



- 5.1 Which component in the diagram indicates that this is an electrolytic cell? (1)
- 5.2 Write down the NAME or FORMULA of the electrolyte **X**. (1)
- 5.3 Write down the balanced equation of the half-reaction that takes place at the silver electrode. (2)
- 5.4 During the reaction, 0,3 mole of electrons are transferred from anode to cathode. Calculate the increase in mass of the cathode electrode. (3)

[7]

**TOTAL: 50**

**TABLE 1: FORMULAE**

$E^{\circ}_{\text{cell}} = E^{\circ}_{\text{(cathode)}} - E^{\circ}_{\text{(anode)}}$	$E^{\circ}_{\text{cell}} = E_{\text{(reduction)}} - E^{\circ}_{\text{(oxidation)}}$
$E^{\circ}_{\text{cell}} = E^{\circ}_{\text{(oxidising agent)}} - E^{\circ}_{\text{(reducing agent)}}$	$n = \frac{m}{M}$

TABLE 3: THE PERIODIC TABLE OF ELEMENTS/TABEL 3: DIE PERIODIEKE TABEL VAN ELEMENTE

1 (I)	2 (II)	3	4	5	6	7	8	9	10	11	12	13 (III)	14 (IV)	15 (V)	16 (VI)	17 (VII)	18 (VIII)
1 H 1																	2 He 4
3 Li 7	4 Be 9															9 F 19	10 Ne 20
11 Na 23	12 Mg 24															17 Cl 35,5	18 Ar 40
19 K 39	20 Ca 40	21 Sc 45	22 Ti 48	23 V 51	24 Cr 52	25 Mn 55	26 Fe 56	27 Co 59	28 Ni 59	29 Cu 63,5	30 Zn 65	31 Ga 70	32 Ge 73	33 As 75	34 Se 79	35 Br 80	36 Kr 84
37 Rb 86	38 Sr 88	39 Y 89	40 Zr 91	41 Nb 92	42 Mo 96	43 Tc 101	44 Ru 101	45 Rh 103	46 Pd 106	47 Ag 108	48 Cd 112	49 In 115	50 Sn 119	51 Sb 122	52 Te 128	53 I 127	54 Xe 131
55 Cs 133	56 Ba 137	57 La 139	72 Hf 179	73 Ta 181	74 W 184	75 Re 186	76 Os 190	77 Ir 192	78 Pt 195	79 Au 197	80 Hg 201	81 Tl 204	82 Pb 207	83 Bi 209	84 Po 209	85 At 210	86 Rn 222
87 Fr 223	88 Ra 226	89 Ac															

58 Ce 140	59 Pr 141	60 Nd 144	61 Pm	62 Sm 150	63 Eu 152	64 Gd 157	65 Tb 159	66 Dy 163	67 Ho 165	68 Er 167	69 Tm 169	70 Yb 173	71 Lu 175
90 Th 232	91 Pa 231	92 U 238	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

1 H 1	2 He 4
3 Li 7	4 Be 9
11 Na 23	12 Mg 24
19 K 39	20 Ca 40
27 Al 27	28 Si 28
31 P 31	32 S 32
35 Cl 35,5	36 Ar 40

29 Cu 63,5	Symbol Simbool
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Electronegativity Elektronegatiwiteit	Atomic number Atoomgetal
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Approximate relative atomic mass Benaderde relatiewe atoommassa
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TABLE 4A: STANDARD REDUCTION POTENTIALS

Half-reactions/Halfreaksies			$E^{\theta}$ (V)
$F_2(g) + 2e^-$	$\rightleftharpoons$	$2F^-$	+ 2,87
$Co^{3+} + e^-$	$\rightleftharpoons$	$Co^{2+}$	+ 1,81
$H_2O_2 + 2H^+ + 2e^-$	$\rightleftharpoons$	$2H_2O$	+1,77
$MnO_4^- + 8H^+ + 5e^-$	$\rightleftharpoons$	$Mn^{2+} + 4H_2O$	+ 1,51
$Cl_2(g) + 2e^-$	$\rightleftharpoons$	$2Cl^-$	+ 1,36
$Cr_2O_7^{2-} + 14H^+ + 6e^-$	$\rightleftharpoons$	$2Cr^{3+} + 7H_2O$	+ 1,33
$O_2(g) + 4H^+ + 4e^-$	$\rightleftharpoons$	$2H_2O$	+ 1,23
$MnO_2 + 4H^+ + 2e^-$	$\rightleftharpoons$	$Mn^{2+} + 2H_2O$	+ 1,23
$Pt^{2+} + 2e^-$	$\rightleftharpoons$	$Pt$	+ 1,20
$Br_2(l) + 2e^-$	$\rightleftharpoons$	$2Br^-$	+ 1,07
$NO_3^- + 4H^+ + 3e^-$	$\rightleftharpoons$	$NO(g) + 2H_2O$	+ 0,96
$Hg^{2+} + 2e^-$	$\rightleftharpoons$	$Hg(l)$	+ 0,85
$Ag^+ + e^-$	$\rightleftharpoons$	$Ag$	+ 0,80
$NO_3^- + 2H^+ + e^-$	$\rightleftharpoons$	$NO_2(g) + H_2O$	+ 0,80
$Fe^{3+} + e^-$	$\rightleftharpoons$	$Fe^{2+}$	+ 0,77
$O_2(g) + 2H^+ + 2e^-$	$\rightleftharpoons$	$H_2O_2$	+ 0,68
$I_2 + 2e^-$	$\rightleftharpoons$	$2I^-$	+ 0,54
$Cu^+ + e^-$	$\rightleftharpoons$	$Cu$	+ 0,52
$SO_2 + 4H^+ + 4e^-$	$\rightleftharpoons$	$S + 2H_2O$	+ 0,45
$2H_2O + O_2 + 4e^-$	$\rightleftharpoons$	$4OH^-$	+ 0,40
$Cu^{2+} + 2e^-$	$\rightleftharpoons$	$Cu$	+ 0,34
$SO_4^{2-} + 4H^+ + 2e^-$	$\rightleftharpoons$	$SO_2(g) + 2H_2O$	+ 0,17
$Cu^{2+} + e^-$	$\rightleftharpoons$	$Cu^+$	+ 0,16
$Sn^{4+} + 2e^-$	$\rightleftharpoons$	$Sn^{2+}$	+ 0,15
$S + 2H^+ + 2e^-$	$\rightleftharpoons$	$H_2S(g)$	+ 0,14
$2H^+ + 2e^-$	$\rightleftharpoons$	$H_2(g)$	0,00
$Fe^{3+} + 3e^-$	$\rightleftharpoons$	$Fe$	- 0,06
$Pb^{2+} + 2e^-$	$\rightleftharpoons$	$Pb$	- 0,13
$Sn^{2+} + 2e^-$	$\rightleftharpoons$	$Sn$	- 0,14
$Ni^{2+} + 2e^-$	$\rightleftharpoons$	$Ni$	- 0,27
$Co^{2+} + 2e^-$	$\rightleftharpoons$	$Co$	- 0,28
$Cd^{2+} + 2e^-$	$\rightleftharpoons$	$Cd$	- 0,40
$Cr^{3+} + e^-$	$\rightleftharpoons$	$Cr^{2+}$	- 0,41
$Fe^{2+} + 2e^-$	$\rightleftharpoons$	$Fe$	- 0,44
$Cr^{3+} + 3e^-$	$\rightleftharpoons$	$Cr$	- 0,74
$Zn^{2+} + 2e^-$	$\rightleftharpoons$	$Zn$	- 0,76
$2H_2O + 2e^-$	$\rightleftharpoons$	$H_2(g) + 2OH^-$	- 0,83
$Cr^{2+} + 2e^-$	$\rightleftharpoons$	$Cr$	- 0,91
$Mn^{2+} + 2e^-$	$\rightleftharpoons$	$Mn$	- 1,18
$Al^{3+} + 3e^-$	$\rightleftharpoons$	$Al$	- 1,66
$Mg^{2+} + 2e^-$	$\rightleftharpoons$	$Mg$	- 2,36
$Na^+ + e^-$	$\rightleftharpoons$	$Na$	- 2,71
$Ca^{2+} + 2e^-$	$\rightleftharpoons$	$Ca$	- 2,87
$Sr^{2+} + 2e^-$	$\rightleftharpoons$	$Sr$	- 2,89
$Ba^{2+} + 2e^-$	$\rightleftharpoons$	$Ba$	- 2,90
$Cs^+ + e^-$	$\rightleftharpoons$	$Cs$	- 2,92
$K^+ + e^-$	$\rightleftharpoons$	$K$	- 2,93
$Li^+ + e^-$	$\rightleftharpoons$	$Li$	- 3,05

Increasing oxidising ability/Toenemende oksiderende vermoë

Increasing reducing ability/Toenemende reducerende vermoë

TABLE 4B: STANDARD REDUCTION POTENTIALS  
TABEL 4B: STANDAARD-REDUKSIEPOTENSIALE

Half-reactions/Halfreaksies	$E^{\ominus}$ (V)
$\text{Li}^+ + \text{e}^- \rightleftharpoons \text{Li}$	-3,05
$\text{K}^+ + \text{e}^- \rightleftharpoons \text{K}$	-2,93
$\text{Cs}^+ + \text{e}^- \rightleftharpoons \text{Cs}$	-2,92
$\text{Ba}^{2+} + 2\text{e}^- \rightleftharpoons \text{Ba}$	-2,90
$\text{Sr}^{2+} + 2\text{e}^- \rightleftharpoons \text{Sr}$	-2,89
$\text{Ca}^{2+} + 2\text{e}^- \rightleftharpoons \text{Ca}$	-2,87
$\text{Na}^+ + \text{e}^- \rightleftharpoons \text{Na}$	-2,71
$\text{Mg}^{2+} + 2\text{e}^- \rightleftharpoons \text{Mg}$	-2,36
$\text{Al}^{3+} + 3\text{e}^- \rightleftharpoons \text{Al}$	-1,66
$\text{Mn}^{2+} + 2\text{e}^- \rightleftharpoons \text{Mn}$	-1,18
$\text{Cr}^{2+} + 2\text{e}^- \rightleftharpoons \text{Cr}$	-0,91
$2\text{H}_2\text{O} + 2\text{e}^- \rightleftharpoons \text{H}_2(\text{g}) + 2\text{OH}^-$	-0,83
$\text{Zn}^{2+} + 2\text{e}^- \rightleftharpoons \text{Zn}$	-0,76
$\text{Cr}^{3+} + 3\text{e}^- \rightleftharpoons \text{Cr}$	-0,74
$\text{Fe}^{2+} + 2\text{e}^- \rightleftharpoons \text{Fe}$	-0,44
$\text{Cr}^{3+} + \text{e}^- \rightleftharpoons \text{Cr}^{2+}$	-0,41
$\text{Cd}^{2+} + 2\text{e}^- \rightleftharpoons \text{Cd}$	-0,40
$\text{Co}^{2+} + 2\text{e}^- \rightleftharpoons \text{Co}$	-0,28
$\text{Ni}^{2+} + 2\text{e}^- \rightleftharpoons \text{Ni}$	-0,27
$\text{Sn}^{2+} + 2\text{e}^- \rightleftharpoons \text{Sn}$	-0,14
$\text{Pb}^{2+} + 2\text{e}^- \rightleftharpoons \text{Pb}$	-0,13
$\text{Fe}^{3+} + 3\text{e}^- \rightleftharpoons \text{Fe}$	-0,06
$2\text{H}^+ + 2\text{e}^- \rightleftharpoons \text{H}_2(\text{g})$	0,00
$\text{S} + 2\text{H}^+ + 2\text{e}^- \rightleftharpoons \text{H}_2\text{S}(\text{g})$	+0,14
$\text{Sn}^{4+} + 2\text{e}^- \rightleftharpoons \text{Sn}^{2+}$	+0,15
$\text{Cu}^{2+} + \text{e}^- \rightleftharpoons \text{Cu}^+$	+0,16
$\text{SO}_4^{2-} + 4\text{H}^+ + 2\text{e}^- \rightleftharpoons \text{SO}_2(\text{g}) + 2\text{H}_2\text{O}$	+0,17
$\text{Cu}^{2+} + 2\text{e}^- \rightleftharpoons \text{Cu}$	+0,34
$2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^- \rightleftharpoons 4\text{OH}^-$	+0,40
$\text{SO}_2 + 4\text{H}^+ + 4\text{e}^- \rightleftharpoons \text{S} + 2\text{H}_2\text{O}$	+0,45
$\text{Cu}^+ + \text{e}^- \rightleftharpoons \text{Cu}$	+0,52
$\text{I}_2 + 2\text{e}^- \rightleftharpoons 2\text{I}^-$	+0,54
$\text{O}_2(\text{g}) + 2\text{H}^+ + 2\text{e}^- \rightleftharpoons \text{H}_2\text{O}_2$	+0,68
$\text{Fe}^{3+} + \text{e}^- \rightleftharpoons \text{Fe}^{2+}$	+0,77
$\text{NO}_3^- + 2\text{H}^+ + \text{e}^- \rightleftharpoons \text{NO}_2(\text{g}) + \text{H}_2\text{O}$	+0,80
$\text{Ag}^+ + \text{e}^- \rightleftharpoons \text{Ag}$	+0,80
$\text{Hg}^{2+} + 2\text{e}^- \rightleftharpoons \text{Hg}(\text{l})$	+0,85
$\text{NO}_3^- + 4\text{H}^+ + 3\text{e}^- \rightleftharpoons \text{NO}(\text{g}) + 2\text{H}_2\text{O}$	+0,96
$\text{Br}_2(\text{l}) + 2\text{e}^- \rightleftharpoons 2\text{Br}^-$	+1,07
$\text{Pt}^{2+} + 2\text{e}^- \rightleftharpoons \text{Pt}$	+1,20
$\text{MnO}_2 + 4\text{H}^+ + 2\text{e}^- \rightleftharpoons \text{Mn}^{2+} + 2\text{H}_2\text{O}$	+1,23
$\text{O}_2(\text{g}) + 4\text{H}^+ + 4\text{e}^- \rightleftharpoons 2\text{H}_2\text{O}$	+1,23
$\text{Cr}_2\text{O}_7^{2-} + 14\text{H}^+ + 6\text{e}^- \rightleftharpoons 2\text{Cr}^{3+} + 7\text{H}_2\text{O}$	+1,33
$\text{Cl}_2(\text{g}) + 2\text{e}^- \rightleftharpoons 2\text{Cl}^-$	+1,36
$\text{MnO}_4^- + 8\text{H}^+ + 5\text{e}^- \rightleftharpoons \text{Mn}^{2+} + 4\text{H}_2\text{O}$	+1,51
$\text{H}_2\text{O}_2 + 2\text{H}^+ + 2\text{e}^- \rightleftharpoons 2\text{H}_2\text{O}$	+1,77
$\text{Co}^{3+} + \text{e}^- \rightleftharpoons \text{Co}^{2+}$	+1,81
$\text{F}_2(\text{g}) + 2\text{e}^- \rightleftharpoons 2\text{F}^-$	+2,87

Increasing oxidising ability/Toenemende oksiderende vermoë

Increasing reducing ability/Toenemende reducerende vermoë

**GERT SIBANDE DISTRICT  
MSTA SUB HUB**

**GRADE 12**

**PHYSICAL SCIENCES TOPIC TEST  
TOPIC: ELECTROCHEMICAL REACTIONS  
JULY 2022  
MEMORANDUM**

**MARKS: 50**

*Stanmorephysics.com*

**This memorandum consists of 3 pages**

### QUESTION 1

- 1.1 D ✓✓  
1.2 A ✓✓  
1.3 D ✓✓

[6]

### QUESTION 2

- 2.1.1 Chemical to electrical. ✓ (1)
- 2.1.2 • Temperature of 25°C / 298 K. ✓  
• Concentration of 1mol.dm<sup>-3</sup> of the solutions.  
[ Any one correct: 1 mark] (1)
- 2.1.3 To complete the circuit ✓ / Provides path for movement of ions/  
Ensures electrical neutrality in the cell/ restores charge balance (1)
- 2.1.4 Nickel sulphate / NiSO<sub>4</sub> or Nickel nitrate / Ni(NO<sub>3</sub>)<sub>2</sub> ✓ (1)
- 2.1.5  $\text{Ni} \longrightarrow \text{Ni}^{2+} + 2\text{e}^-$  ✓✓ (2)
- 2.2  $E_{\text{cell}}^0 = E_{\text{cathode}}^0 - E_{\text{anode}}^0$  ✓ (OR: 1,07 V ✓ =  $E_{\text{cathode}}^0 - (-0,27)$  ✓  
 $E_{\text{cathode}}^0 = +0,8 \text{ V}$  ✓ (  $E^0 = +0,8 \text{ V}$  is silver ) (4)
- 2.3 Ni ✓ (1)
- [11]

### QUESTION 3

- 3.1.1 A substance that gains electrons. ✓✓ (2)
- 3.1.2 Salt bridge ✓ (1)
- 3.1.3 Co<sup>2+</sup> ✓ (1)
- 3.1.4  $E_{\text{cell}}^0 = E_{\text{cathode}}^0 - E_{\text{anode}}^0$  ✓ ( OR:  $E_{\text{cell}}^0 = E_{\text{reduction}}^0 - E_{\text{oxidation}}^0$  )  
 $E^0 = (-0,28) - (-2,36)$  ✓  
 $E^0 = +2,08 \text{ V}$  ✓ (3)
- 3.2.1 Is the increase in oxidation number. ✓✓ (2)
- 3.2.2 Platinum/Pt ✓ (1)
- 3.2.3 Ag<sup>+</sup> ✓ (1)
- 3.2.4 Pt (s) | Fe<sup>2+</sup> (aq), Fe<sup>3+</sup> (aq) ✓ || Ag<sup>2+</sup> (aq) | Ag (s) ✓ (3)

[14]

### QUESTION 4

4.1 Is the chemical process in which electrical energy is converted to chemical energy. ✓✓

**OR:** Is the use of electrical energy to produce a chemical change. (2)

4.2 ENDOTHERMIC ✓ (1)

- 4.3
- It is inert / inactive / Does not take part in the reaction.
  - It is a good conductor of electricity.
  - It does not affect the discharge of ions in the electrolyte.
  - It has a very high melting point. [ Any one correct: 1 mark] ✓ (1)

4.4.1 NaCl ✓ (1)

4.4.2  $2\text{H}_2\text{O (l)} + 2\text{e}^- \longrightarrow \text{H}_{2(\text{g})} + 2\text{OH}^-_{(\text{aq})}$  ✓ (2)

4.4.3  $2\text{Cl}^-_{(\text{aq})} \longrightarrow \text{Cl}_{2(\text{g})} + 2\text{e}^-$  ✓ (2)

4.5  $\text{H}_2\text{O}$  is a stronger oxidising agent than  $\text{Na}^+$  ✓ and will be reduced to  $\text{H}_2$ . ✓ (2)

4.6 NaOH /  $\text{OH}^-$  is formed ✓ (1)

[12]

### QUESTION 5

5.1 Battery/cell ✓ (1)

5.2 silver nitrate/ $\text{AgNO}_3$  ✓ (1)

5.3  $\text{Ag} \longrightarrow \text{Ag}^+ + \text{e}^-$  ✓ (2)

5.4  $n(\text{e}^-) : n(\text{Ag}^+) = 1:1$

$$n(\text{Ag}) = 0,3 \text{ mol}$$

$$n(\text{Ag}^+) = \frac{m}{M} \checkmark$$

$$0,3 = \frac{m}{108} \checkmark$$

$$m(\text{Ag}^+) = 32,4\text{g} \checkmark (3)$$

[7]

**TOTAL: 50**