basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

PHYSICAL SCIENCES: CHEMISTRY (P2)

FEBRUARY/MARCH 2011

MEMORANDUM

MARKS: 150

This memorandum consists of 17 pages.

Learning Outcomes and Assessment Standards		
LO 1	**LO 2**	**LO 3**
AS 12.1.1: Design, plan and conduct a scientific inquiry to collect data systematically with regard to accuracy, reliability and the need to control variables. **AS 12.1.2:** Seek patterns and trends, represent them in different forms, explain the trends, use scientific reasoning to draw and evaluate conclusions, and formulate generalisations. **AS 12.1.3:** Select and use appropriate problem-solving strategies to solve (unseen) problems. **AS 12.1.4:** Communicate and defend scientific arguments with clarity and precision.	**AS 12.2.1:** Define, discuss and explain prescribed scientific knowledge. **AS 12.2.2** Express and explain prescribed scientific principles, theories, models and laws by indicating the relationship between different facts and concepts in own words. **AS 12.2.3:** Apply scientific knowledge in everyday life contexts.	**AS 12.3.1:** Research, discuss, compare and evaluate scientific and indigenous knowledge systems and knowledge claims by indicating the correlation among them, and explain the acceptance of different claims. **AS 12.3.2:** Research case studies and present ethical and moral arguments from different perspectives to indicate the impact (pros and cons) of different scientific and technological applications. **AS 12.3.3:** Evaluate the impact of scientific and technological research and indicate the contribution to the management, utilisation and development of resources to ensure sustainability continentally and globally.

GENERAL GUIDELINES

1. CALCULATIONS

1.1 Award marks for: correct formula, correct substitution, correct answer with unit.

1.2 Do no award any marks if an incorrect or inappropriate formula is used, even though there may be relevant symbols and applicable substitutions.

1.3 When an error is made during **substitution into a correct formula**, award a mark for the correct formula and for the correct substitutions, but **do not give any further marks**.

1.4 If no formula is given, but all substitutions are correct, the candidate forfeits one mark.

Example:
No K_c expression, correct substitution

$$K_c = \frac{(2)^2}{(2)(1)^3} \checkmark = 2 \checkmark \left(\frac{2}{3}\right)$$

1.5 Marks can only be allocated for substitutions when values are substituted into formulae and not when listed before a calculation starts.

1.6 All calculations, when not specified in the question, must be done to two decimal places.

2. DEFINITIONS

Award two marks for a correct definition. Do not award any marks for an incorrect or partially correct definition.

3. UNITS

3.1 Candidates must be penalised only once for the repeated use of an incorrect unit **within a question or subquestion**.

3.2 Units are only required in the final answer to a calculation.

3.3 Award marks for an answer only, and not for a unit *per se*. Candidates forfeit the mark allocated for the answer in each of the following situations:
- Correct answer + wrong unit
- Wrong answer + correct unit
- Correct answer + no unit

3.4 Separate compound units with a multiplication dot, not a full stop, for example, $mol{\cdot}dm^{-3}$. Accept $mol.dm^{-3}$ (or mol/dm^3) for marking purposes

4. GENERAL

4.1 If one answer or calculation is required, but the candidate gives two, mark only the first one, irrespective of which one is correct. If two answers are required, mark only the first two, etc.

4.2 When a chemical **FORMULA** is asked, and the **NAME** is given as answer the candidate forfeits the marks. The same rule applies when the **NAME** is asked and the **FORMULA** is given.

4.3 When redox half-reactions are to be written, the correct arrow should be used. If the equation

$$H_2S \rightarrow S + 2\,H^+ + 2e^- \quad (2/2)$$

is the correct answer, the marks must be given as follows:

$H_2S \rightleftharpoons S + 2\,H^+ + 2e^-$ $(1/2)$

$H_2S \leftarrow S + 2\,H^+ + 2e^-$ $(0/2)$

$S + 2H^+ + 2e^- \leftarrow H_2S$ $(2/2)$

$S + 2H^+ + 2e^- \rightleftharpoons H_2S$ $(0/2)$

4.4 When candidates are required to give an explanation involving the relative strength of oxidising and reducing agents, do not accept the folowing:
- Stating the position of a substance on table 4 only (e.g. Cu is above Mg).
- Using relative reactivity only (e.g. Mg is more reactive than Cu).
- The correct answer would be for instance: Mg is a stronger reducing agent than Cu, and therefore Mg will be able to reduce Cu^{2+} ions to Cu. The answer can also be given in terms of the relative strength as electron acceptors and donors.

4.5 One mark is forfeited when the charge of an ion is omitted per equation.

4.6 The error carrying principle does not apply to chemical equations or half reactions. For example, if a learner writes the wrong oxidation/reduction half-reaction in the sub-question and carries the answer to another sub-question (balancing of equations or calculation of E^θ_{cell}) then the learner must not be credited for this substitution.

4.7 In the structural formula of an organic molecule all hydrogen atoms must be shown. Marks must be deducted if hydrogen atoms are omitted.

4.8 When a structural formula is asked, marks must be deducted if the learner writes the condensed formula.

4.9 When an IUPAC name is asked and the candidate omits the hyphen (e.g. instead of pent-1-ene or 1-pentene the candidate writes pent 1 ene or 1 pentene), marks must be forfeited.

4.10 When a chemical reaction is asked, marks are awarded for correct reactants, correct products and correct balancing.

4.11 If only a reactant(s) followed by an arrow, or only a product(s) preceded by an arrow, is/are written, marks may be awarded for the reactant(s) or product(s). If only a reactant(s) or only a product(s) are written, without an arrow, no marks are awarded for the reactant(s) or product(s).

Examples: $N_2 + 3H_2$ ✓ $\rightarrow NH_3$ ✓ bal. ✓

$N_2 + 3H_2 \rightarrow$ ✓	$^1\!/_3$
$\rightarrow NH_3$ ✓	$^1\!/_3$
$N_2 + 3H_2$	$^0\!/_3$
NH_3	$^0\!/_3$

5. POSITIVE MARKING

Positive marking regarding calculations is followed in the following cases:

5.1 **Subquestion to subquestion:** When a certain variable is calculated in one sub-question (e.g. 3.1) and needs to be substituted in another (3.2 or 3.3), e.g. if the answer for 3.1 is incorrect and is substituted correctly in 3.2 or 3.3, **full marks must** be awarded for the subsequent subquestions.

5.2 **A multi-step question in a subquestion**: If the candidate has to calculate, for example, the number of moles in the first step and gets it wrong due to a substitution error, the mark for the substitution and the final answer is forfeited.

5.3 If a final answer to a calculation is correct, full marks are not automatically awarded. Markers must always ensure that the correct/appropriate formula is used and that workings, including substitutions, are correct.

SECTION A

QUESTION 1

1.1	Viscosity ✓	[12.2.1]	(1)
1.2	Catalyst ✓	[12.2.1]	(1)
1.3	Sulphuric acid / H_2SO_4 ✓	[12.2.1]	(1)
1.4	Anode ✓	[12.2.1]	(1)
1.5	Haber/Haber-Bosch (process) ✓	[12.2.1]	(1)
			[5]

QUESTION 2

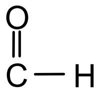
2.1	D ✓✓	[12.2.3]	(2)
2.2	C ✓✓	[12.2.3]	(2)
2.3	B ✓✓	[12.2.3]	(2)
2.4	A ✓✓	[12.2.3]	(2)
2.5	B ✓✓	[12.2.3]	(2)
2.6	A ✓✓	[12.2.1]	(2)
2.7	B ✓✓	[12.2.3]	(2)
2.8	C ✓✓	[12.2.1]	(2)
2.9	D ✓✓	[12.2.3]	(2)
2.10	A ✓✓	[12.2.1]	(2)
			[20]

TOTAL SECTION A: 25

SECTION B

QUESTION 3

3.1 3.1.1

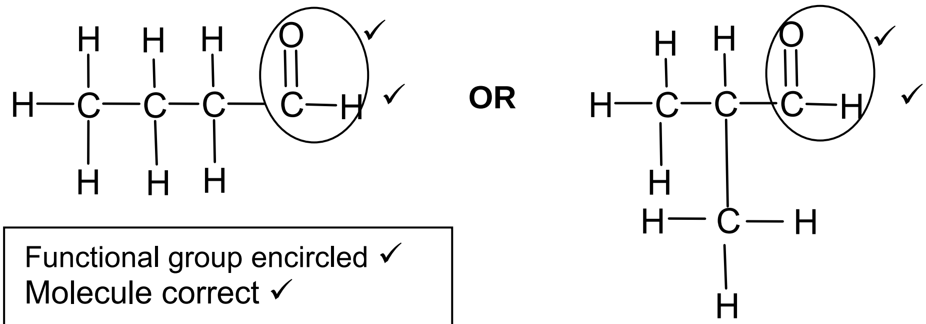
IF:  ✓ (only 1 mark)

Condensed or semi-structural formula: Max. $\frac{1}{2}$

[12.2.3] (2)

3.1.2 Ketones ✓ [12.2.3] (1)

3.1.3



Functional group encircled ✓ Molecule correct ✓
Condensed or semi-structural formula: Max. $\frac{1}{2}$
Molecular formula: $\frac{0}{2}$

[12.2.3] (2)

3.1.4 1-bromo-2-chloro ✓ cyclopentane ✓ [12.1.4] (2)

If hyphens omitted: Max $\frac{1}{2}$

3.2 Tertiary ✓ (1)

[12.2.3] **[8]**

QUESTION 4

4.1 The temperature ✓ at which the vapour pressure of a liquid is equal to the external (atmospheric) pressure. ✓ [12.2.1] (2)

4.2 A (propane) ✓

IF: it is between propane and pentane. $\frac{1}{2}$

It has four carbon atoms. $\frac{1}{2}$ [12.2.1] (1)

4.3 Butane ✓✓ [12.1.2] (2)

4.4 4.4.1 Compounds with the same molecular formula, ✓ but different structural formulae. ✓ [12.2.1] (2)

4.4.2 Compound C / 2-methylbutane is more branched/more compact/more spherical/has a shorter chain/has a smaller surface area.✓
Weaker intermolecular forces/ Van der Waals forces/dispersion forces/London forces.✓
Less energy needed to overcome intermolecular forces. ✓

OR

Compound B / Pentane is less branched/has a longer chain/less compact/less spherical/has a larger surface area. ✓
Stronger intermolecular forces / Van der Waals forces. ✓
More energy needed to overcome intermolecular forces. ✓ [12.1.4] (3)

4.5 The Van der Waals forces in B (pentane) ✓ are weaker ✓ than the hydrogen bonds in D (pentan-1-ol) ✓ and requires less energy ✓ to break. [12.1.4] (4)

[14]

QUESTION 5

5.1 5.1.1 It contains a <u>double bond</u>/C = C) between two carbon atoms in its hydrocarbon chain. ✓

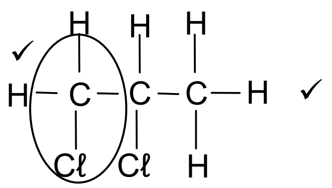
OR

All carbon atoms not bonded to the maximum number of atoms /four atoms. [12.2.1] (1)

5.1.2 (a) Addition ✓ [12.2.3] (1)

(b) Substitution ✓ [12.2.3] (1)

5.1.3



Functional group encircled ✓
Molecule correct ✓

Condensed or semi-structural formula: Max.	$\frac{1}{2}$
Molecular formula:	$\frac{0}{2}$

[12.2.3] (2)

5.1.4 Heat / sunlight / ultraviolet light/ hf ✓ [12.2.1] (1)

5.1.5 Butane ✓ [12.2.3] (1)

5.1.6 Hydrogen chloride / HCℓ ✓ Accept: Hydrochloric acid [12.2.3] (1)

5.2 5.2.1 Elimination ✓ [12.2.1] (1)

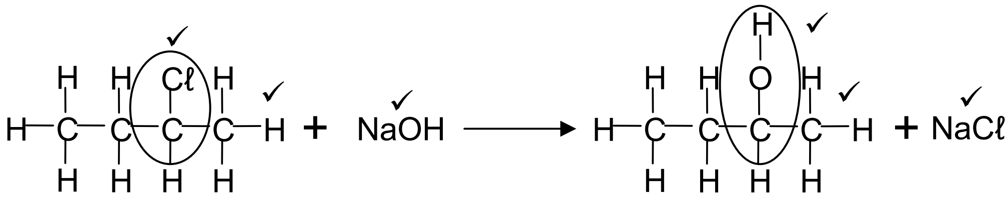
5.2.2 But-2-ene ✓ ✓

Accept: 2-✓butene ✓

If hyphens omitted: Max $\frac{1}{2}$

[12.2.3] (2)

5.2.3
- If an equation is written and the arrow is left out: -1 mark
- Marking rule 3.11



Ignore: ⇌	
Functional group encircled ✓ Molecule correct ✓	Accept: –OH condensed in structural formula.
Condensed/semi-structural formulae or mixture of both Max $\frac{5}{6}$	
Molecular formula for all structures, Eg. C_3H_7Cl Max $\frac{2}{6}$	
Any additional reactant or products: *Max* $\frac{5}{6}$	*Everything correct,* ***wrong balancing*** *Max* $\frac{5}{6}$

[12.2.3] (6)

5.2.4 Hydrolysis ✓ [12.2.1] (1)

5.3 5.3.1 ANY ONE:
Diseases ✓like malaria are contained. ✓
Provide food security ✓through healthy crops. ✓ [12.3.2] (2)

5.3.2 ANY ONE:
- Contaminates fruit and vegetables ✓ that can lead to illness, e.g. cancer✓
- Spraying of crops ✓can result in respiratory problems. ✓
- Inhaling ✓ (while spraying) can result in illness. ✓

[12.3.2] (2)
[22]

QUESTION 6

6.1 6.1.1 State of division (of solid) / Reaction surface✓ [12.1.1] (1)

Criteria for investigative question	Mark
The dependent and indeoendent variables are stated.	✓
Asks a quesion about the relationship between the dependent and independent variables.	✓

Example:
How will the state of division/ reaction surface / surface area influence the rate of the reaction?

OR
What is the relationship between state of division/ reaction surface / surface area and reaction rate? [12.1.1] (2)

6.1.3 Greater surface area✓✓ / state of division / reaction surface

IF ONLY: Surface area/reaction surface/state of division: Max: $\frac{1}{2}$

[12.1.1] (2)

6.2 6.2.1 Concentration (of HCℓ) ✓ [12.1.1] (1)

6.2.2

Criteria for hypothesis:	Mark
The dependent and indeoendent variables are stated.	✓
Makes perdition about about the relationship between the dependent and independent variables.	✓

Example:
The higher the concentration (of the reactant / acid), the higher the rate of the reaction.

OR
The higher the concentration, the lower the rate of the reaction.

OR
Reaction rate increases with decrease in concentration.

OR
Reaction rate increases with increase in concentration.

OR
Reaction rate is proportional/directly proportional/inversely proportional to concentration. [12.1.1] (2)

6.2.3 Yes✓
All other variables that affect the reaction rate are constant.✓

OR
The volume of the acid will not affect the rate of the reaction. ✓

OR
There is only one independent variable

OR
Concentration is the only variable that changes

OR
Concentration is the only independent variable [12.1.1] (2)

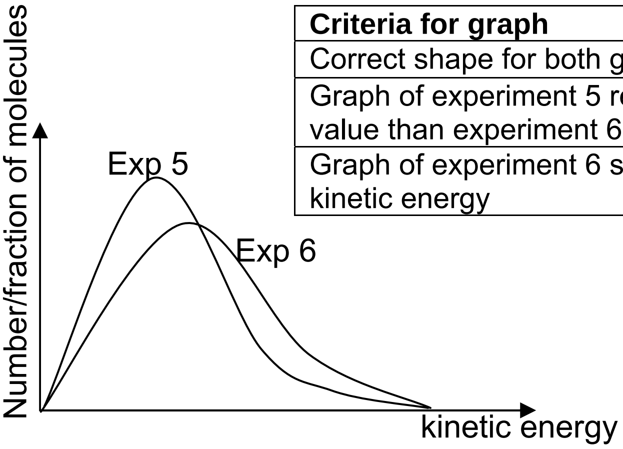
6.2.4 Equal to✓ (any equivalent correct answer)
$CaCO_3$ is the limiting reactant. ✓

OR
equal to ✓
The same amount/number of moles/mass of $CaCO_3$ reacts in both experiments✓. [12.1.1] (2)

6.3 6.3.1 Lower than✓ (any equivalent corrcet answer)

OR
Larger than in exeperiment 6. [12.1.2] (1)

6.3.2



Criteria for graph	Mark
Correct shape for both graphs	✓
Graph of experiment 5 reaches a higher maximum/peak value than experiment 6.	✓
Graph of experiment 6 shows more molecules of higher kinetic energy	✓

[12.1.2] (3)

6.4 6.4.1 Exothermic ✓
Reactants at higher energy than products / $\Delta H < 0$ ✓ [12.1.2] (2)

6.4.2 (a) A ✓ [12.1.2] (1)

(b) C - B ✓ [12.1.2] (1)
[20]

QUESTION 7

7.1 ANY ONE: ✓

- Use fertilisers sparingly. / Do not over-fertilise.
- Make use of precision (computerised) application of fertilisers.
- Ensure that water from fields does not run into rivers/dams.
- Redirect water from fields into reservoirs/away from rivers/dams. [12.2.3] (1)

7.2 Ostwald Process ✓ [12.2.1] (1)

7.3 $HNO_3 + NH_3$ ✓ → NH_4NO_3 ✓ ✓ bal. [12.2.3] (3)

7.4 7.4.1 The <u>concentration of nitrogen</u> ✓ is <u>increased</u>.✓ / More nitrogen ✓ was added. ✓ [12.2.1] (2)

7.4.2 The <u>pressure</u> ✓on the system is <u>increased</u>.✓ [12.1.2] (2)

7.4.3 The <u>temperature</u> ✓is increased. ✓ [12.1.2] (2)

7.5 t_1 ✓ and t_2 ✓ [12.2.2] (2)

7.6 **Calculation using number of moles**
Mark allocation:

- Use of $n = \frac{m}{M}$ ✓
- $n(NH_3)$ at equilibrium = 1,2 mol ✓
- Using ratio $n(N_2)$: $n(H_2)$: $n(NH_3)$ = 1:3:2 ✓
- $n(N_2)$ at equilibrium (initial - change) ✓
- $n(H_2)$ at equilibrium (initial - change) ✓
- Divide by volume ✓
- K_c expression ✓
- Substitution into K_c expression ✓
- Final answer: 0,25 ✓

<u>**Option 1:**</u>

$n(NH_3) = \frac{m}{M} = \frac{20,4}{17}$ ✓ = 1,2 mol ✓ OR give two marks in table for 1,2 mol

	N_2	H_2	NH_3	
Molar ratio	1	3	2	
Initial quantity (mol)	5	5	0	
Change (mol)	0,6	1,8	1,2	Ratio ✓
Quantity at equilibrium (mol)	4,4 ✓	3,2 ✓	1,2 ✓✓	
Concentration ($mol \cdot dm^{-3}$)	0,88	0,64	0,24	Divide by 5 ✓

+

$$K_c = \frac{[NH_3]^2}{[N_2][H_2]^3} \checkmark = \frac{(0,24)^2}{(0,88)(0,64)^3} \checkmark = 0,25 \checkmark$$

No K_C expression, correct substitution: Max. $\frac{8}{9}$

Wrong K_C expression: Max. $\frac{6}{9}$

Option 2:

At equilibrium: $n(NH_3) = \frac{m}{M} = \frac{20,4}{17}$ ✓= 1,2 mol✓

Reacted: $n(H_2) = 1\frac{1}{2}\,n(NH_3) = 1,8$ mol
$n(N_2) = \frac{1}{2}\,n(NH_3) = 0,6$ mol ✓

At equilibrium: $n(H_2) = 5 – 1,8 = 3,2$ mol ✓
$n(N_2) = 5 – 0,6 = 4,4$ mol ✓

$c(H_2) = \frac{n}{V} = 0,64\ mol·dm^{-3}$
$c(N_2) = \frac{n}{V} = 0,88\ mol·dm^{-3}$
$c(NH_3) = \frac{n}{V} = 0,24\ mol·dm^{-3}$ ✓

$K_c = \frac{[NH_3]^2}{[N_2][H_2]^3}$ ✓= $\frac{(0,24)^2}{(0,88)(0,65)^3}$ ✓ = 0,25 ✓

Wrong K_C expression: Max. 6/9

No K_C expression, correct substitution: Max. 8/9

Calculations using concentrations

Mark allocation:

- Use of $c = \frac{m}{M \times V}$ ✓
- $[NH_3]$ at equilibrium = $0,24\ mol·dm^{-3}$✓
- Using concentration ratio $[N_2]: [H_2] : [NH_3]$ = 1:3:2 ✓
- Divide by volume ✓
- Equilibrium concentration of N_2 (initial - change) ✓
- Equilibrium concentration of H_2 (initial - change) ✓
- K_c expression ✓
- Substitution into K_c expression ✓
- Final answer: 0,25 ✓

Option 3:

$n(NH_3) = \frac{m}{M} = \frac{20,4}{17}$ = 1,2 mol and $c = \frac{n}{V} = \frac{1,2}{5}$ ✓ = $0,24\ mol·dm^{-3}$✓

OR $c(NH_3) = \frac{m}{M \times V} = \frac{20,4}{17 \times 5}$ ✓= $0,24\ mol·dm^{-3}$ ✓ OR 2 marks for answer in table

	N_2	H_2	NH_3	
Molar ratio	1	3	2	
Initial concentration ($mol·dm^{-3}$)	1	1 ✓	0	Divide by 5
Change in concentration ($mol·dm^{-3}$)	0,12	0,36	0,24	Ratio ✓
Equilibirum concentration ($mol·dm^{-3}$)	0,88✓	0,64 ✓	0,24 ✓✓	Deduction

$K_c = \frac{[NH_3]^2}{[N_2][H_2]^3}$ ✓= $\frac{(0,24)^2}{(0,88)(0,65)^3}$ ✓ = 0,25 ✓

Wrong K_C expression: Max. 6/9

No K_C expression, correct substitution: Max. 8/9

Calculations using masses:
<u>Option 4</u>:

Use formula $n = \frac{m}{M}$ ✓

$n(N_2) = \frac{m}{M} \therefore 5 = \frac{m}{28} \quad \therefore m = 140\ g$

$n(H_2) = \frac{m}{M} \therefore 5 = \frac{m}{2} \quad \therefore m = 10\ g$

✓ or 1 mark in table

	N_2	H_2	NH_3	
Initial mass (g)	140	10 ✓	0	
Change in mass (g)	16,8	3,6	20,4	
Mass at equilibrium (g)	123,4✓	6,4✓	20,4	
Equilibrium Concentration ($mol{\cdot}dm^{-3}$)	0,88	0,64	0,24	✓

$$K_c = \frac{[NH_3]^2}{[N_2][H_2]^3} ✓ = \frac{(0,24)^2}{(0,88)(0,65)^3} ✓ = 0,25 ✓$$

No K_C expression, correct substitution: Max. $\frac{8}{9}$	K_C expression: Max. $\frac{6}{9}$

[12.1.3] (9)
[22]

QUESTION 8

8.1 Chemical (potential) energy ✓to electrical (potential) energy ✓ [12.2.1] (2)

8.2 Temperature = 25 °C /298 K ✓
Concentration of electrolytes = 1 mol·dm^{-3} ✓ [12.2.1] (2)

8.3 - Magnesium / Mg ✓
Magnesium is a stronger reducing agent, ✓ (than Ag)
therefore Mg will be oxidised/;ose electrons. [12.1.4] (3)

8.4 $Mg \mid Mg^{2+}$ ✓ (1 mol·dm^{-3}) ✓ || Ag^+ (mol·dm^{-3}) | Ag ✓

OR
$Mg \mid Mg^{2+} \parallel Ag^+ \mid Ag$

OR
Mg(s) | Mg^{2+} (aq) || Ag^+ (aq | Ag(s) [12.2.3] (3)

8.5 $Mg + 2Ag^+$ ✓ → $Mg^{2+} + 2Ag$ ✓ bal✓ $\boxed{\text{Accept: } \rightleftharpoons}$ [12.2.3] (3)

8.6 Increases. ✓ (Or any equivalent word)
The rate of the forward reaction increases ✓ (when [Ag^+] increases.) /
Tendency for the reaction to proceed from left to right increases.
More electrons are released per unit time. ✓ [12.2.3] (3)
[16]

QUESTION 9

9.1 The process in which electrons are lost by a substance. ✓✓ [12.2.1] (2)

9.2 Reduction ✓ [12.2.3] (1)

9.3 $Ag^+(aq) + e^- \rightarrow Ag(s)$ ✓✓ [12.2.3] (2)

$Ag^+ + e^- \rightleftharpoons Ag$	($\frac{1}{2}$)
$Ag \rightarrow Ag^+ + e^-$	($\frac{0}{2}$)
$Ag \leftarrow Ag^+ + e^-$	($\frac{2}{2}$)
$Ag \rightleftharpoons Ag^+ + e^-$	($\frac{0}{2}$)

9.4 Silver / Ag ✓ [12.2.3] (1)

9.5 The rate of oxidation (of Ag) equals the rate of reduction (of Ag^+). ✓✓ [12.2.3]
IF: Equilibrium is reached. $\frac{0}{2}$ (2)
[8]

QUESTION 10

10.1 Secondary ✓ [12.2.3] (1)

10.2

If net equation contains substances not cancelled on both sides: minus 1 mark	Marking rule 3.11
	Ignore: $\rightleftharpoons$

$Pb + 2H_2SO_4 + PbO_2$ ✓$\rightarrow 2PbSO_4 + 2H_2O$✓ ✓ bal.

OR

$Pb + 2HSO_4^- + PbO_2 + 2H^+$✓$\rightarrow 2PbSO_4 + 2H_2O$ ✓ ✓ bal. [12.2.3] (3)

10.3 $E^\theta_{cell} = E^\theta_{cathode} - E^\theta_{anode}$ ✓
$= (1,70)$ ✓$- (-0,36)$ ✓
$= 2,06$ V ✓

OR: Any other correct formula from data sheet

$\therefore$ Emf of 6 cell battery = (6)(2,06) = 12,36 V ✓

OR:
$Pb(s) + SO_4^{2-}(aq) \rightarrow PbSO_4(aq) + 2e^-$ $E° = +0,36$ ✓
$PbSO_4(aq) + 2H_2O + 2e^- \rightarrow PbO_2(s) + SO_4^{2-}(aq)$ $\underline{E° = +1,70}$ ✓
$E° = +2,06V$ ✓

Any other formula using unconventional abbreviations, e.g.
$E°_{cell} = E°_{OA} - E°_{RA}$ followed by correct substitutions: $\frac{4}{5}$

[12.2.3] (5)

10.4 $q = I\Delta t$ ✓
20 x 3 600✓ = $5\Delta t$ ✓
$\Delta t = 14\ 400$ s ✓

OR
$q = I\ \Delta t$ ✓
20 ✓= $5\Delta t$ ✓
$\Delta t = 4$ hours ✓ [12.2.3] (4)

10.5 ANY TWO: ✓✓
Acid used as electrolyte can contaminate groundwater.
Plastic casings are non-degradable and can pollute the environment.
Lead (in electrodes) is a heavy metal and can harm crops/plants. [12.3.2] (2)
[15]

TOTAL SECTION B: 125
GRAND TOTAL: 150