DEPARTEMENT CHEMIE
DEPARTMENT OF CHEMISTRY

100 1908 - 2008

UNIVERSITEIT VAN PRETORIA
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CMY 117
SEMESTERTOETS 1 / *SEMESTER TEST 1*

DATUM / DATE: 22 Februarie 2010
TYD / TIME: 2 ure / hours
PUNTE / MARKS: 100

EKSAMINATORE: Dr PB Ramatsetse
EXAMINERS: Dr JB Laurens
Prof. WJ Schoeman

EKSTERN / EXTERNAL: Mev A Botha
Mev B Castleman

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AFDELING A / *SECTION A*

VAN EN VOORLETTERS: Memorandum ----------
SURNAME AND INITIALS:

REGISTRASIENOMMER: ---------- **GRAADKURSUS:** ----------
REGISTRATION NUMBER: ***DEGREE COURSE:***

HANDTEKENING / *SIGNATURE* : ----------

VRAAG QUESTION	PUNTE MARKS		EKSAMINATOR EXAMINER
1		15	
2		15	
3		15	
4		15	
TOTAAL:AFDELING A TOTAL:SECTION A		60	
TOTAAL:AFDELING B TOTAL:SECTION B		40	
TOTAAL / TOTAL		100	

INSTRUKSIES	INSTRUCTIONS
Alle berekeninge, sketse en diagramme moet in ink gegee word. Alle berekeninge moet volledig getoon word. Antwoorde moet tot die korrekte aantal betekenisvolle syfers gegee word. 'n Datablad is aangeheg aan Afdeling B.	All answers (calculations, sketches, and diagrams) must be given in ink. All calculations must be shown in full. Ans wers must be given to the correct number of significant figures. An information page is attached to Section B.

Vraag 1 **Metingseenhede en Omskakelings** [15]	**Question 1** **Units of Measurement and Conversions** [15]
1.1 Die afmetings van 'n kamer is 12.51 m x 17.5 m x 1.80 m. Die konsentrasie koolstofmonoksied in die lug van hierdie kamer is 48 $\mu g.\ell^{-1}$. Bereken die totale massa koolstofmonoksied in die kamer in milligram. Skryf die antwoord in wetenskaplike notasie. [6]	1.1 The dimensions of a room are 12.51 m x 17.5 m x 1.80 m. The concentration of carbon monoxide in the air of this room is 48 $\mu g.\ell^{-1}$. Calculate the total mass of carbon monoxide in the room in milligram. Write the answer in scientific notation. [6]

Volume of room

$= 12.51 \times 17.5 \times 1.80\ m^3$

$= 394\ m^3$

$= 394\ mm^3 \times \left(\frac{10\ dm}{m}\right)^3 \times \left(\frac{\ell}{dm^3}\right)$

$= 3.94 \times 10^5\ \ell$

Mass of $CO_{(g)}$

$= 3.94 \times 10^5\ \ell \times 48\ \mu g/\ell$

$= 1.9 \times 10^7\ \mu g$

$= 1.9 \times 10^7\ \mu g \times \left(\frac{10^{-6}\ g}{1\ \mu g}\right) \times \left(\frac{10^3\ mg}{1\ g}\right)$

$= 1.9 \times 10^4\ mg.$

1.2 Die afmetings van 'n boer se land is 2.459 myl x 1.75 myl.
Molibdeensulfaat moet by die grond gevoeg word teen 'n konsentrasie van 7.5 $mg.m^{-2}$.
Die kunsmis wat hiervoor gebruik word het 'n molibdeensulfaat-inhoud van 65%.
Bereken die massa kunsmis wat benodig word vir hierdie land in kilogram. [9]

1.2 The dimensions of a farmer's field are 2.459 miles x 1.75 miles.
Molybdenum sulphate must be added to the soil of this land at a concentration of 7.5 $mg.m^{-2}$.
The fertiliser used for this purpose has a molybdenum sulphate content of 65%.
Calculate the mass of fertiliser required for this land in kilograms. [9]

Oppervlakte van land

$= 2.459 \times 1.75 \text{ myl}^2$

$= 4.30 \text{ myl}^2$

$= 4.30 \text{ myl}^2 \times \left(\frac{1760 \text{ yrt}}{1 \text{ myl}}\right)^2 \times \left(\frac{3 \text{ voet}}{1 \text{ yrt}}\right)^2 \times \left(\frac{12 \text{ duim}}{1 \text{ voet}}\right)^2$

$\times \left(\frac{2.54 \text{ cm}}{1 \text{ duim}}\right)^2 \times \left(\frac{1 \text{ m}}{100 \text{ cm}}\right)^2$

$= 1.11 \times 10^7 \text{ m}^2$

Massa $MoSO_4$

$= 1.11 \times 10^7 \times 7.5$

$= 8.4 \times 10^7 \text{ mg}$

$= 8.4 \times 10^4 \text{ g}$

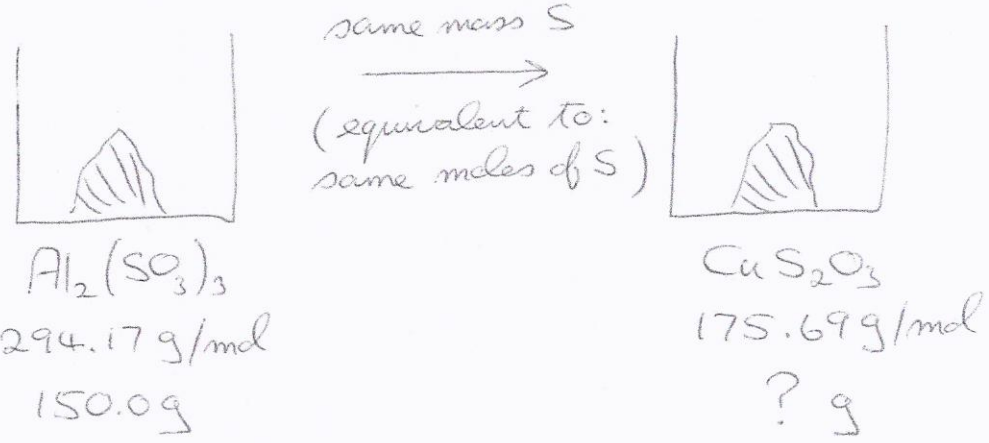
$= 8.4 \times 10^1 \text{ kg} = 84 \text{ kg}$

Massa kunsmis

$= \frac{84}{0.65} = (129) \text{ kg}$

$= 1.3 \times 10^2 \text{ kg}$

Vraag 2 Molberekeninge [15]	Question 2 Mole Calculations [15]
2.1 Bereken die massa (in gram) koper(II)tiosulfaat wat dieselfde massa swael bevat as wat teenwoordig is in 150.0 g aluminium sulfiet. [7]	2.1 Calculate the mass (in gram) of copper(II) thiosulphate which contains the same mass of sulphur as is present in 150.0 g of aluminium sulphite. [7]



1. $n(Al_2(SO_3)_3) = \frac{150.0}{294.17}$

$= 0.5099$ mol

$n(S)$ in the sample $= 0.5099 \times 3$

$= 1.530$ mol

2. Thus, in the CuS_2O_3 sample is also 1.530 moles of S.

$n(S) = 1.530$ mol

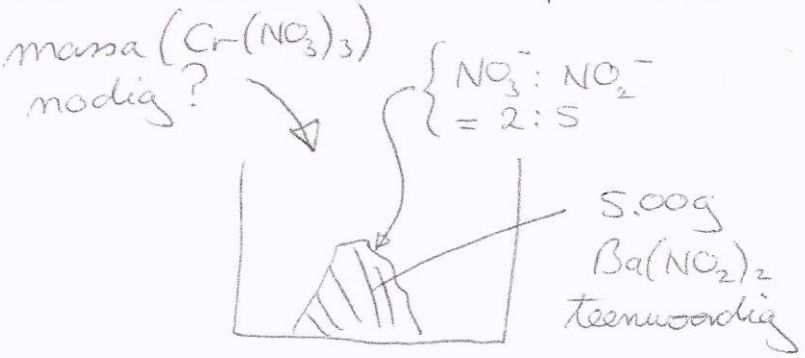
$\Rightarrow n(CuS_2O_3) = \frac{1.530}{2} = 0.7649$ mol

$\Rightarrow$ mass$(CuS_2O_3) = 0.7649 \times 175.69$

$= 134.4$ g.

2.2 'n Vaste stof mengsel moet gemaak word waarin die verhouding van die aantal nitraatione tot nitrietione 2:5 is.
Bereken die massa (in gram) chroom(III)nitraat wat met 5.00 g bariumnitriet gemeng moet word om hierdie mengsel te lewer. [8]

2.2 A solid mixture is to be made in which the ratio of the numbers of nitrate ions to nitrite ions is 2:5.
Calculate the mass (in gram) of chromium(III) nitrate that should be mixed with 5.00 g of barium nitrite to yield this mixture. [8]



$M(Cr(NO_3)_3) = 238.03$ g/mol

$M(Ba(NO_2)_2) = 229.35$ g/mol

1. $n(Ba(NO_2)_2)$ teenwoordig

$= \frac{5.00}{229.35} = 0.0218$ mol

$n(NO_2^-)$ teenwoordig

$= 0.0218 \times 2 = 0.0436$ mol

2. $n(NO_3^-)$ nodig:

$\frac{n(NO_3^-)}{n(NO_2^-)} = \frac{2}{5} = \frac{x}{0.0436}$

$\Rightarrow n(NO_3^-) = x = 0.0174$ mol

3. $n(Cr(NO_3)_3) = \frac{0.0174}{3}$

$= 0.00581$ mol

massa $(Cr(NO_3)_3) = 0.00581 \times 238.03$

$= 1.38$ g

Vraag 3		Question 3	
Chemiese Formules	**[15]**	**Chemical Formulas**	**[15]**

3.1 'n Suur, ge-ekstraeer uit plantmateriaal, bevat slegs die elemente C, H en O.
Verbrandingsanalise van 0.513 g van die suur lewer 0.501 g CO_2 en 0.103 g H_2O.
Dit is ook bekend dat die molêre massa van die suur 90.04 $g.mol^{-1}$is.
Bereken die molekulêre formule van die suur.**[10]**

3.1 An acid, extracted from plant material, contains only the elements C, H and O. When 0.513 g of this acid is analysed by combustion analysis, 0.501g of CO_2 and 0.103g H_2O result.
It is also known that the molar mass of this acid is 90.04 $g.mol^{-1}$.
Calculate the molecular formula of this acid. **[10]**

Formula : $C_xH_yO_z$

$$\underset{0.513g}{C_xH_yO_z} + O_2 \longrightarrow \underset{0.501g}{\overset{44.01g/mol}{CO_2}} + \underset{0.103g}{\overset{18.02g/mol}{H_2O}}$$

1. $n(CO_2) = \frac{0.501}{44.01} = 0.0114\ mol$

$\Rightarrow n(C) = 0.0114\ mol$

$\Rightarrow mass(C) = 0.0114 \times 12.01 = 0.137\ g$

2. $n(H_2O) = \frac{0.103}{18.02} = 0.00572\ mol$

$\Rightarrow n(H) = 2 \times 0.00572\ mol = 0.0114\ mol$

$\Rightarrow mass(H) = 0.0114 \times 1.01 = 0.0116\ g$

3. mass (O) in compound

$= 0.513 - 0.137 - 0.0116 = 0.365\ g$

$n(O) = \frac{0.365}{16.00} = 0.0228\ mol$

4. Empirical formula: $C_{0.0114}H_{0.0114}O_{0.0228}$

$\Rightarrow CHO_2$

5. Factor = $\frac{90.04}{45.02} = 2$

6. Molecular formula: $CHO_2 \times 2 \Rightarrow C_2H_2O_4$

3.2 265 mg asetaat word vir 'n eksperiment benodig. Bereken die massa (in gram) magnesiumasetaat wat hiervoor benodig word. [5]

3.2 265 mg of acetate is needed in an experiment. Calculate the mass (in gram) of magnesium acetate required for this. [5]

$M(Mg(CH_3COO)_2) = 142.41\ g/mol$

$M(CH_3COO^-) = 59.05\ g/mol$

Metode 1 :

1. $n(CH_3COO^-) = \frac{0.265}{59.05} = 0.00449\ mol$

2. $\Rightarrow n(Mg(CH_3COO)_2) = \frac{0.00449}{2} = 0.00224\ mol$

3. $\Rightarrow massa(Mg(CH_3COO)_2) = 0.00224 \times 142.41$
$= 0.320\ g$

Metode 2 :

1. % CH_3COO^- - inhoud van $Mg(CH_3COO)_2$
$= \frac{2 \times 59.05}{142.41} \times 100 = 82.93\ \%$

2. Gestel die massa $Mg(CH_3COO)_2$ is x g.

3. 82.93 % van x g is 265 mg (asetaat)
$\Rightarrow 0.8293x = 0.265$
$x = 0.320\ g$
$\Rightarrow massa(Mg(CH_3COO)_2) = 0.320\ g$

Vraag 4 Stoigiometrie [15]	Question 4 Stoichiometry [15]
Beskou die volgende reaksievergelyking:	Consider the following reaction equation:

$$13F_2 + 2MnI_2 \rightarrow 2MnF_3 + 4IF_5$$

420.0 g F_2 en 500.0 g MnI_2 word gemeng en toegelaat om te reageer.	420.0 g of F_2 and 500.0 g of MnI_2 were mixed and allowed to react.
4.1 Bereken watter massa mangaan(III)fluoried vorm as aangeneem word dat die reaksie 100% verloop. [8]	4.1 Calculate what mass of manganese(III) fluoride will form if it is assumed that the reaction takes place 100%. [8]

$M(F_2) = 38.00\ g/mol$ $M(IF_5) = 221.90\ g/mol$

$M(MnI_2) = 308.74\ g/mol$

$M(MnF_3) = 111.94\ g/mol$

1. Determine the limiting reagent.

If 420.0 g F_2 reacts in full:

mass of MnF_3 formed

$$= \frac{420.0}{38.00} \times \frac{2}{13} \times 111.94 = 190.3\ g$$

If 500.0 g MnI_2 reacts in full:

mass of MnF_3 formed

$$= \frac{500.0}{308.74} \times \frac{2}{2} \times 111.94 = 181.3 g$$

$\Rightarrow MnI_2$ is the limiting reactant.

$\Rightarrow$ 181.3 g MnF_3 forms.

4.2 261 g IF_5 word verkry.
Bereken die persentasie opbrengs van die reaksie t.o.v. IF_5. [7]

4.2 261 g of IF_5 was produced.
Calculate the percent yield of the reaction with reference to IF_5. [7]

1. Maximum IF_5 that can be formed:
(start from the limiting reactant)

$$= \frac{500.0}{308.74} \times \frac{4}{2} \times 221.90$$

$$= 718.7\ g$$

2. But only 261 g IF_5 was produced

$$\% \text{ yield} = \frac{261}{718.7} \times 100$$

$$= 36.3\ \%$$

CMY 117
Semester Test 1
22 February 2010
Section B

QUESTION	ANSWER	MARKS
1	J	0
2	C	2
3	E	2
4	A	2
5	B	2
6	H	3
7	C	3
8	C	3
9	C	2
10	J	2
11	B	2
12	F	2
13	F	3
14	B	2
15	I	2
16	J	2
17	I	3
18	C	3
		40