LEES DIE VOLGENDE INSTRUKSIES DEEGLIK

Antwoorde op vrae moet in die oopgelate ruimtes by elke vraag gegee word.

Die rugkante van bladsye kan ook gebruik word, maar dan moet dit duidelik by die vraag aangedui word. Dit kan ook vir rofwerk gebruik word.

Die vraestel moet in pen voltooi word.

'n Periodiek tabel en oplosbaarheidstabel is aangeheg en jy mag die bladsye afskeur vir gebruik.

Sakrekenaars is toelaatbaar. Die sakrekenaarfasiliteit op selfone is nie toegelaat nie.

Avogadrogetal (N_A): 6,022 x 10^{23} mol^{-1}

Alle berekeninge moet getoon word!

READ THE FOLLOWING INSTRUCTIONS THOROUGHLY

Answers on questions must be given in the blank spaces below each question.

The back of pages can also be used, but it should then be indicated at each question. It can also be used for own scribbling.

The paper must be completed in pen.

A periodic table and solubility tabel is attached and you may tear it off for use.

Calculators are allowed. The calculator facility on mobile phones is not allowed.

Avogadro's number (N_A): 6,022 x 10^{23} mol^{-1}

All calculations must be shown!

VRAAG 1. / *QUESTION 1.* **[40 PUNTE. / *40 MARKS*.]**

Beide kampusse se studente antwoord vraag 1.1 / *Students from both campuses answer question 1.1*

1.1 Skryf die formules of name van die volgende verbindings neer. / *Write down the formulas or names of the following compounds.* **[4]**

1.1.1 Tin(IV)fluoried. / Tin(IV) fluoride.

1.1.2 PbO_2

1.1.3 Kaliumperchloraat. / *Potassium perchlorate*.

1.1.4 KCl

Beide kampusse se studente antwoord vraag 1.2 / *Students from both campuses answer question 1.2*

1.2 Wat is die simbool vir die ioon met 63 protone, 60 elektrone en 89 neutrone? / *What is the symbol for the ion with 63 protons, 60 electrons and 89 neutrons?* **[1]**

Beide kampusse se studente antwoord vraag 1.3 / *Students from both campuses answer question 1.3*

1.3 Bereken die massapersentasie aluminium in $Ca_3Al_2O_6$ (Trikalsiumaluminaat). / *Calculate the mass percentage aluminium in $Ca_3Al_2O_6$ (Tricalcium aluminate).* **[2]**

Beide kampusse se studente antwoord vraag 1.4 / *Students from both campuses answer question 1.4*

1.4 'n Element X Het vyf hoof isotope wat hieronder saam met hul persentasie voorkoms gelys word. Bereken die gemiddelde relatiewe atoommassa en identifiseer dan die element. / *An element X has five main isotopes, which are listed below along with their percentage abundances. Calculate the average relative atomic mass **and** then identify the element.* **[2]**

Isotope	**% Abandance**	**Relative mass (amu)**
^{46}X	8.00	45.95269
^{47}X	7.30	46.951764
^{48}X	73.80	47.947947
^{49}X	5.50	48.947841
^{50}X	5.40	49.944792

Beide kampusse se studente antwoord vraag 1.5 / *Students from both campuses answer question 1.5*

1.5 Wanneer waterigeoplossings van Na_2SO_4 en $Pb(NO_3)_2$ gemeng word, presipiteer $PbSO_4$ uit. Bereken die massa $PbSO_4$ (in gram) wat vorm wanneer 1.25 L van 'n 0.0500 M $Pb(NO_3)_2$ oplossing en 2.00 L van 'n 0.0250 M Na_2SO_4 oplossings gemeng word. / *When aqueous solutions of Na_2SO_4 and $Pb(NO_3)_2$ are mixed, $PbSO_4$ precipitates. Calculate the mass of $PbSO_4$ (in grams) formed when a 1.25 L solution of 0.0500 M $Pb(NO_3)_2$ and a 2.00 L solution of 0.0250 M Na_2SO_4 are mixed.* **[7]**

Beide kampusse se studente antwoord vraag 1.6 / *Students from both campuses answer question 1.6*

1.6 Bereken die massa NH_4ClO_4 (in kg) wat nodig is vir 1 kg Al. / *Calculate the mass of NH_4ClO_4 (in kg) that is nessessary for 1 kg of Al.* **[5]**

$$3Al\ (s) + 3NH_4ClO_4\ (s) \rightarrow Al_2O_3\ (s) + AlCl_3\ (s) + 3NO\ (g) + 6H_2O\ (g)$$

Beide kampusse se studente antwoord vraag 1.7 / *Students from both campuses answer question 1.7*

1.7 Om die alkohol inhoud van 'n sekere wyn te bepaal het 'n chemikus 1.00 L van 'n waterige oplossing 0.200 M $K_2Cr_2O_7$ (kaliumdichromaat) nodig. Bereken die massa (in gram) soliede $K_2Cr_2O_7$ wat afgeweeg moet word om hierdie oplossing voor te berei? / *To analyze the alcohol content of a certain wine, a chemist needs 1.00 L of an aqueous 0.200 M $K_2Cr_2O_7$ (potassium dichromate) solution. Calculate the mass (in gram) of solid $K_2Cr_2O_7$ that must be weighed out to make this solution?* **[3]**

Beide kampusse se studente antwoord vraag 1.8 / *Students from both campuses answer question 1.8*

1.8 Bereken die molhoeveelheid Cl^- ione in 1.75 L van 'n 1.0 x 10^{-3} M $AlCl_3$ oplossing. / *Calculate the mole amount of Cl^- ions in 1.75 L of a 1.0 x 10^{-3} M $AlCl_3$ solution.* **[3]**

Beide kampusse se studente antwoord vraag 1.9 / *Students from both campuses answer question 1.9*

1.9 Beskou die volgende reaksie en beantwoord dan die daaropvolgende vrae: / *Consider the following reaction and then answer the following questions:*

$$2H_2\,(g) + O_2\,(g) \rightarrow 2H_2O\,(\ell) \qquad \Delta H = -\,572\ kJ$$

1.9.1 Hoeveel hitte word vrygestel vir die vorming van 1.00 mol H_2O (ℓ)? / *How much heat is evolved for the production of 1.00 mol H_2O (ℓ)?* **[1]**

1.9.2 Hoeveel hitte word vrygestel wanneer 4.03 g waterstof met 'n oormaat suurstof reageer? / *How much heat is evolved when 4.03 g hydrogen is reacted with excess oxygen?* **[2]**

Beide kampusse se studente antwoord vraag 1.10 / *Students from both campuses answer question 1.10*

1.10 Gegewe die volgende data: / *Given the following data:*

1. Fe_2O_3 (s) + 3CO (g) → 2Fe (s) + $3CO_2$ (g) ΔH = - 23 kJ
2. $3Fe_2O_3$ (s) + CO (g) → $2Fe_3O_4$ (s) + CO_2 (g) ΔH = - 39 kJ
3. Fe_3O_4 (s) + CO (g) → 3FeO (s) + CO_2 (g) ΔH = 18 kJ

Bereken ΔH vir die volgende reaksie: / *Calculate ΔH for the following reaction:* **[6]**

4. FeO (s) + CO (g) → Fe (s) + CO_2 (g) Δ**H = ?**

Beide kampusse se studente antwoord vraag 1.11 / *Students from both campuses answer question 1.11*

1.11 Voltooi die volgende reaksievergelykings deur van die oplosbaarheidstabel aan die einde van hierdie vraestel gebruik te maak. Balanseer die vergelykings en wys die fisiese toestande van al die produkte.

Using the solubility table at the back of this paper, complete the following reaction equations. Balance the equations and show the physical states of all the products. **[4]**

1.11.1 ____ Na_2SO_4 (aq) + ____ $Pb(NO_3)_2$ (aq) →

1.11.2 ____ $SrCl_2$ (aq) + ____ Ag_2SO_4 (aq) →

VRAAG 2. / *QUESTION 2.* **[21 PUNTE. / 21 *MARKS*.]**

Beide kampusse se studente antwoord vraag 2.1 / *Students from both campuses answer question 2.1*

2.1 Steenkool wat hoofsaaklik koolstof is, kan na natuurlike gas,metaangas (CH_4), omgeskakel word deur die volgende eksotermiese reaksie. / *Coal, which is primarily carbon, can be converted to natural gas, primarily methane gas (CH_4), by the following exothermic reaction.*

$$C(s) + 2H_2(g) \leftrightarrows CH_4(g)$$

Indien die reaksie in ewewig is, voorspel die effek van: / *If this reaction mixture is at equilibrium, predict the effect of:* **[3]**

Voeg nog C by die reaksiemengsel. *Adding more C to the reaction mixture.*	
Voeg nog H_2 by die reaksiemengsel. *Adding more H_2 to the reaction mixture.*	
Verhoog die temperatuur van die reaksiemengsel. *Raising the temperature of the reaction mixture.*	

Beide kampusse se studente antwoord vraag 2.2 / *Students from both campuses answer question 2.2*

2.2 Veronderstel 0.0864 mol Br_2 word in 'n 1.44 L fles geplaas en dan verhit tot 1756 K, 'n temperatuur waar die halogeen begin dissosieer na atome: Br_2 (g) ⇆ 2Br (g).
Suppose 0.0864 mol of Br_2 is placed in a 1.44 L flask and heated to 1756 K, a temperature at which the halogen starts to dissociate to atoms: $Br_2(g)$ ⇆ 2Br(g)

Indien Br_2 slegs 12.3% gedissosieer is by hierdie temperatuur wat is K_c? / *If Br_2 is only 12.3% dissociated at this temperature, what is K_c.* **[4]**

Beide kampusse se studente antwoord vraag 2.3 / *Students from both campuses answer question 2.3*

2.3 Gebruik die gegewe inligting hieronder om die daarop volgende vrae te beantwoord.
Use the given information below to answer the questions that follow.

$$2Fe^{3+}(aq) + 3I^-(aq) \leftrightarrows 2Fe^{2+}(aq) + I_3^-(aq)$$

	$2Fe^{3+}$ (aq)	$3I^-$ (aq) ⇆	$2Fe^{2+}$ (aq)	I_3^- (aq)
A (I)	0.300 M	0.200 M		
V (C)				
E (E)				0.025 M

2.3.1 Bereken die ewewigskonsentrasies van al die reagense en oorblywende produk. / *Calculate the equilibrium concentrations of all the reagents and remaining product.* **[3]**

2.3.2 Bereken die ewewigskonstante, K_c. / *Calculate the equilibrium constant, K_c.* **[2]**

2.3.3 Is bogenoemde reaksie 'n reagensbevoordeelde of produkbevoordeelde reaksie? / *Is the reaction above a reagent favoured or a product favoured reaction?* **[1]**

Beide kampusse se studente antwoord vraag 2.4 / *Students from both campuses answer question 2.4*

2.4 'n Mengsel van stikstof, waterstof en ammoniak is tot ewewig gebring. Wanneer die vergelyking geskryf word deur van heelgetal koëffisiente gebruik te maak, soos volg, is die waarde van K = 3.5 x 10^8.
A mixture of nitrogen, hydrogen and ammonia is brought to equilibrium. When the equation is written using whole-number coefficients, as follows, the value of K is 3.5 x 10^8.

Vergelyking 1. / *Equation 1.* $N_2\,(g) + 3H_2\,(g) \leftrightarrows 2NH_3\,(g)$ $K_1 = 3.5 \times 10^8$

2.4.1 Wat is die waarde van K vir die volgende reaksie? / *What is the value of K for the following reaction?* **[1]**

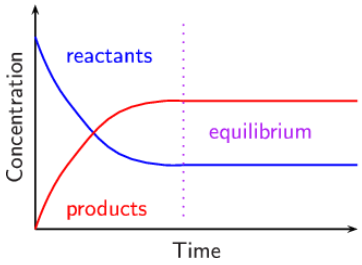
Vergelyking 2. / *Equation 2.* $\frac{1}{2}N_2\,(g) + 1\frac{1}{2}H_2\,(g) \leftrightarrows NH_3\,(g)$ **K_2 = ?**

2.4.2 Wat is die waarde van K vir die volgende reaksie? / *What is the value of K for the following reaction?* **[1]**

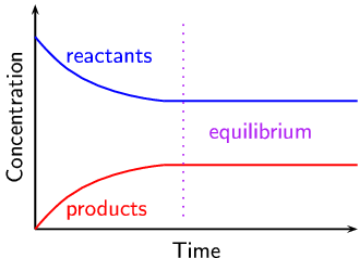
Vergelyking 3. / *Equation 3.* $2NH_3\,(g) \leftrightarrows N_2\,(g) + 3H_2\,(g)$ **K_3 = ?**

Beide kampusse se studente antwoord vraag 2.5 / *Students from both campuses answer question 2.5*

2.5 Beskou die volgende twee chemiese ewewigsgrafieke. / *Look at the following two chemical equilibrium graphs.*



A



B

2.5.1 In watter grafiek is die reaksie produkbevoordeeld? / *In which graph is the reaction product favoured?* **[1]**

2.5.2 In watter grafiek is die reaksie reagensbevoordeeld? / *In which graph is the reaction reactant favoured?* **[1]**

Beide kampusse se studente antwoord vraag 2.6 / *Students from both campuses answer question 2.6*

2.6 Die ewewigskonstante, K_c vir die volgende reaksie is: / *The equilibrium constant K_c for the reaction is:*

$$2NOCl(g) \rightleftharpoons 2NO(g) + Cl_2(g) \qquad K_c = 3.9 \times 10^{-3} \text{ at } 300\ ^0C.$$

'n Mengsel bevat die gasse by die volgende konsentrasies: / *A mixture contains the gases at the following concentrations:*

$[NOCl] = 5.0 \times 10^{-3}$ mol/dm^3

$[NO] = 2.5 \times 10^{-3}$ mol/dm^3

$[Cl_2] = 2.0 \times 10^{-3}$ mol/dm^3

Is die reaksie in ewewig by 300 ^{0}C? Indien nie, in watter rigting sal die reaksie verloop om ewewig te bereik? / *Is the reaction at equilibrium at 300 ^{0}C? If not, in which direction does the reaction proceed to come to equilibrium?* **[4]**

VRAAG 3. / *QUESTION 3.* **[19 PUNTE. / 19 *MARKS*.]**

Beide kampusse se studente antwoord vraag 3.1 / *Students from both campuses answer question 3.1*

3.1 Vir die volgende reaksie, identifiseer die suur, die basis, die gekonjugeerde basis en die gekonjugeerde suur. / *For the following reaction, identify the acid, the base, the conjugate base and the conjugate acid.* **[2]**

$$C_5H_5NH^+ (aq) + H_2O (\ell) \leftrightarrows C_5H_5N (aq) + H_3O^+ (aq)$$

Beide kampusse se studente antwoord vraag 3.2 / *Students from both campuses answer question 3.2*

3.2 Skryf die gebalanseerde dissosiasiereaksievergelyking **en** die ewewigskonstanteuitdrukking, K_a vir die volgende suur in water neer. / *Write down the balanced dissociation reaction equation **and** the equilibrium constant expression, K_a for the following acid in water.* **[3]**

$CH_3NH_3^+ (aq)$ +

Beide kampusse se studente antwoord vraag 3.3 / *Students from both campuses answer question 3.3*

3.3 Die pH van 'n waterige oplossing van 1.00×10^{-2} M HOCN is 2.77 by 25 ^{0}C. Bereken K_a vir HOCN. *The pH of an aqueous solution of 1.00×10^{-2} M HOCN is 2.77 at 25 ^{0}C. Calculate K_a for HOCN.* **[5]**

Beide kampusse se studente antwoord vraag 3.4 / *Students from both campuses answer question 3.4*

3.4 Bereken die [OH^-] van 'n oplossing met 'n [H^+] gelyk aan 8.3 x 10^{-16} M. Klassifiseer dan ook die oplossing as neutral, suur of basies deur die opsie te omkring wat jy dink korrek is. / *Calculate the [OH^-] of a solution with a [H^+] equal to 8.3 x 10^{-16} M. Then also classify the solution as neutral, acidic or basic by circling the option that you think is correct.* **[2]**

Berekening: / *Calculation:*

Klassifikasie: / *Classification:*

Neutraal. / *Neutral.* Suur. / *Acidic.* Basies. / *Basic.*

Beide kampusse se studente antwoord vraag 3.5 / *Students from both campuses answer question 3.5*

3.5 'n Tipiese aspirientablet bevat 325 mg asetielsalisielsuur acid ($HC_9H_7O_4$; $M_{HC9H7O4}$ = 180.08 g.mol^{-1}). Bereken die pH van 'n oplossing wat berei is deur twee aspirientablette in een koppie water (237 mL) op te los. Aanvaar dat die aspirientablette suiwer asetielsalisielsuur is. Die K_a waarde van asetielsalisielsuur is 3.3 x 10^{-4}.

A typical aspirin tablet contains 325 mg of acetylsalicylic acid ($HC_9H_7O_4$; $M_{HC9H7O4}$ = 180.08 g.mol^{-1}). Calculate the pH of a solution that is prepared by dissolving two aspirin tablets in one cup (237 mL) of water. Assume the aspirin tablets are pure acetylsalicylic acid. The K_a value for acetylsalicylic acid is 3.3 x 10^{-4}. **[7]**

$$HC_9H_7O_4\ (aq) + H_2O\ (\ell) \leftrightarrows C_9H_7O_4^-\ (aq) + H_3O^+\ (aq)$$

VRAAG 4. / *QUESTION 4.* **[20 PUNTE. / 20 *MARKS*.]**

Beide kampusse se studente antwoord vraag 4.1 / *Students from both campuses answer question 4.1*

4.1 Jy wil 'n 1.0 L bufferoplossing met 'n pH van 4.30 berei. 'n Lys van moontlike sure (en hul gekonjugeerde basisse) word gegee: / *You wish to prepare 1.0 L of a buffer solution with a pH of 4.30. A list of possible acids (and their conjugate bases) is given:*

Suur. / *Acid.*	**Gekonjugeerde basis. *Conjugate base.***	**K_a**	**pK_a**
HSO_4^-	SO_4^{2-}	1.2×10^{-2}	1.92
CH_3COOH	CH_3COO^-	1.8×10^{-5}	4.74
HCO_3^-	CO_3^{2-}	4.8×10^{-11}	10.32

Watter suur/basis kombinasie moet gebruik word as buffer **en** wat moet die verhouding van die suur en gekonjugeerde basis wees? / *Which combination should be selected as a buffer solution **and** what should be the ratio of the acid to conjugate base?* **[6]**

Beide kampusse se studente antwoord vraag 4.2 / *Students from both campuses answer question 4.2*

4.2 Bereken die wateroplosbaarheid van Ag_3PO_4 (K_{sp} = 1.8 x 10^{-18} and M_{Ag3PO4} = 418.7 g.mol^{-1}) in mol per liter **en** in gram per liter. / *Calculate the water solubility of Ag_3PO_4 (K_{sp} = 1.8 x 10^{-18} and M_{Ag3PO4} = 418.7 g.mol^{-1}) in moles per litre **and** in grams per litre.* **[7]**

Beide kampusse se studente antwoord vraag 4.3 / *Students from both campuses answer question 4.3*

4.3 Sal 'n presipitaat vorm wanneer 50 cm^3 van 'n 5 x 10^{-4} mol/dm^3 $Ca(NO_3)_2$ oplossing by 'n 50 cm^3 van 'n 2 x 10^{-4} mol/dm^3 NaF oplossing gevoeg word? (K_{sp} (CaF_2) = 1.7 x 10^{-10}). / *Will a precipitate form when 50 cm^3 of a 5 x 10^{-4} mol/dm^3 $Ca(NO_3)_2$ solution is added to 50 cm^3 of a 2 x 10^{-4} mol/dm^3 NaF solution? (K_{sp} (CaF_2) = 1.7 x 10^{-10}).* **[7]**

$$CaF_2\ (s) \leftrightarrows Ca^{2+}\ (aq) + 2F^-\ (aq)$$

JY MAG HIERDIE BLADSY AFSKEUR!

YOU MAY TEAR OF THIS PAGE!

PERIODIC TABLE OF THE ELEMENTS
PERIODIEKE INDELING VAN DIE ELEMENTE

IA (1)				IVB (4)	VB (5)	VIB (6)	VIIB (7)	VIII (8)	VIII (9)	VIII (10)	IB (11)	IIB (12)	IIIA (13)	IVA (14)	VA (15)	VIA (16)	VIIA (17)	0 (18)
1 **H** 1,01	IIA (2)																	2 **He** 4,00
3 **Li** 6,94	4 **Be** 9,01												5 **B** 10,8	6 **C** 12,0	7 **N** 14,0	8 **O** 16,0	9 **F** 19,0	10 **Ne** 20,2
11 **Na** 23,0	12 **Mg** 24,3	IIIB (3)											13 **Al** 27,0	14 **Si** 28,1	15 **P** 31,0	16 **S** 32,1	17 **Cl** 35,45	18 **Ar** 39,9
19 **K** 39,1	20 **Ca** 40,1	21 **Sc** 45,0		22 **Ti** 47,9	23 **V** 50,9	24 **Cr** 52,0	25 **Mn** 54,9	26 **Fe** 55,9	27 **Co** 58,9	28 **Ni** 58,7	29 **Cu** 63,4	30 **Zn** 65,4	31 **Ga** 69,7	32 **Ge** 72,6	33 **As** 74,9	34 **Se** 79,0	35 **Br** 79,9	36 **Kr** 83,8
37 **Rb** 85,5	38 **Sr** 87,6	39 **Y** 88,9		40 **Zr** 91,2	41 **Nb** 92,9	42 **Mo** 95,9	43 **Tc** (98)	44 **Ru** 101,1	45 **Rh** 102,9	46 **Pd** 106,4	47 **Ag** 107,9	48 **Cd** 112,4	49 **In** 114,8	50 **Sn** 118,7	51 **Sb** 121,6	52 **Te** 127,6	53 **I** 127,9	54 **Xe** 131,3
55 **Cs** 132,9	56 **Ba** 137,3	57 **La** 138,9	*	72 **Hf** 178,5	73 **Ta** 180,9	74 **W** 183,9	75 **Re** 186,2	76 **Os** 190,2	77 **Ir** 192,2	78 **Pt** 195,1	79 **Au** 197,0	80 **Hg** 200,6	81 **Tl** 204,4	82 **Pb** 207,2	83 **Bi** 209,0	84 **Po** (209)	85 **At** (210)	86 **Rn** (222)
87 **Fr** (223)	88 **Ra** 226,0	89 **Ac** 227,0	#	104 **Rf** (261)	105 **Db** (262)	106 **Sg** (263)	107 **Bh** (262)	108 **Hs** (265)	109 **Mt** (266)									

atomic number / atoomgetal
symbol / simbool
atomic mass / atoommassa

lanthanides* / lantaniede	58 **Ce** 140,1	59 **Pr** 140,9	60 **Nd** 144,2	61 **Pm** (145)	62 **Sm** 150,4	63 **Eu** 152,0	64 **Gd** 157,3	65 **Tb** 158,9	66 **Dy** 162,5	67 **Ho** 164,9	68 **Er** 167,3	69 **Tm** 168,9	70 **Yb** 173,0	71 **Lu** 175,0
actinides# / aktiniede	90 **Th** 232,0	91 **Pa** 231,0	92 **U** 238,0	93 **Np** 237,0	94 **Pu** (244)	95 **Am** (234)	96 **Cm** (247)	97 **Bk** (247)	98 **Cf** (251)	99 **Es** (252)	100 **Fm** (257)	101 **Md** (258)	102 **No** (258)	103 **Lr** (260)

TABEL 1: Oplosbaarheidstabel.

TABLE 1: Solubility Table.

Soluble compounds		**Exceptions**
Almost all salts of Na^+, K^+ and NH_4^+		
All salts of Cl^-, Br^- and I^-	⇔	Halides of Ag^+, Hg_2^{2+} and Pb^{2+}
Compounds containing F^-	⇔	Fluorides of Mg^{2+}, Ca^{2+}, Sr^{2+}, Ba^{2+} and Pb^{2+}
Salts of nitrate, NO_3^-; chlorate, ClO_3^-; perchlorate, ClO_4^-; acetate, CH_3COO^-		$KClO_4$
Salts of sulphate, SO_4^{2-}	⇔	Sulphates of Sr^{2+}, Ba^{2+} and Pb^{2+}

Insoluble compounds		**Exceptions**
All salts of carbonate, CO_3^{2-}; phosphate, PO_4^{3-} oxalate, $C_2O_4^{2-}$; chromate, CrO_4^{2-}; sulphide, S^{2-} Most metal hydroxides OH^- and oxides, O^{2-}	⇔	Salts of NH_4^+ and alkali metal cations

TOTAL/TOTAAL: 100