UNIVERSITY OF SWAZILAND

SUPPLEMENTARY EXAMINATION – 2014, MAY

TITLE OF PAPER : Introductory Chemistry II

COURSE NUMBER : C112

TIME : Three Hours

INSTRUCTIONS :

1. **Answer all questions in Section A** (Total 50 marks)
2. **Answer any two questions in Section B** (each question is 25 marks)

NB: Non-programmable electronic calculators may be used

A data sheet, a periodic table and answer sheet (for **Section A**) are attached

Useful data and equations:

1 atm = 760 Torr = 760 mmHg

1 atm = 101325 Pa

Arrhenius equation: $k = Ae^{-E_a/RT}$ or $lnk = lnA - \frac{E_a}{RT}$

Van der Walls equation: $P = \frac{nRT}{V-nb} - \frac{n^2a}{V^2}$

This Examination Paper Contains Twelve Printed Pages Including This Page

You are not supposed to open the paper until permission to do so has been granted by the Chief Invigilator.

1. At 27°C, $K_p = 0.095$ for the equilibrium:
$NH_4HS\ (s) \longrightarrow NH_3\ (g) + H_2S\ (g)$
A sample of solid NH_4HS is placed in a closed vessel and allowed to equilibrate. Calculate the equilibrium partial pressure (atm) of ammonia, assuming that some solid NH_4HS remains.
   A) 0.31
   B) 0.095
   C) 0.052
   D) 0.0049
   E) 3.8

2. Consider the following chemical reaction:
$H_2\ (g) + I_2\ (g) \longrightarrow 2HI\ (g)$
At equilibrium in a particular experiment, the concentrations of H_2, I_2, and HI were 0.25 M, 0.035 M, and 0.55 M, respectively. The value of K_{eq} for this reaction is _____.
   A) 23
   B) 63
   C) 0.0090
   D) 5.1
   E) 34

3. Which one of the following is true concerning the Haber process?
   A) It is a process used for shifting equilibrium positions to the right for more economical chemical synthesis of a variety of substances.
   B) It is a process used for the synthesis of ammonia.
   C) It is another way of stating Le Châtelier's principle.
   D) It is an industrial synthesis of sodium chloride that was discovered by Karl Haber.
   E) It is a process for the synthesis of elemental chlorine.

4. If 30.0 L of oxygen are cooled from 200°C to 1°C at constant pressure, what is the new volume of oxygen?
   A. 0.150 L
   B. 17.4 L
   C. 23.0 L
   D. 51.8 L
   E. 6.00×10^3 L

5. If the pressure of a gas sample is quadrupled and the absolute temperature is doubled, by what factor does the volume of the sample change?
   A. 8
   B. 2
   C. 1/2
   D. 1/4
   E. 1/8

6. If the pressure on a gas sample is tripled and the absolute temperature is quadrupled, by what factor will the volume of the sample change?
   A. 12

B. 4/3

C. 3/4

D. 1/3

E. 4

7. The temperature of an ideal gas in a 5.00 L container originally at 1 atm pressure and 25°C is lowered to 220 K. Calculate the new pressure of the gas.

A. 1.0 atm

B. 1.35 atm

C. 8.8 atm

D. 0.738 atm

E. 0.114 atm

8. At what temperature will a fixed amount of gas with a volume of 175 L at 15°C and 760 mmHg occupy a volume of 198 L at a pressure of 640 mm Hg?

A. 274°C

B. 214°C

C. 114°C

D. 1°C

E. -59°C

9. Calculate the volume occupied by 35.2 g of methane gas (CH4) at 25°C and 1.0 atm. R = 0.0821 L atm/K mol.

A. 0.0186 L

B. 4.5 L

C. 11.2 L

D. 49.2 L

E. 53.7 L

10. Calculate the volume occupied by 25.2 g of CO2 at 0.84 atm and 25°C.

A. 0.060 L

B. 1.34 L

C. 16.9 L

D. 24.2 L

E. 734 L

12. How many molecules of N_2 gas can be present in a 2.5 L flask at 50°C and 650 mmHg?

A. 2.1 × 10-23 molecules

B. 4.9 × 1022 molecules

C. 3.1 × 1023 molecules

D. 3.6 × 1025 molecules

E. 0.081 molecules

13. A calorimeter temperature increases by 0.45 °C when 30 J of energy is added to it by electrical heating. When 0.10 grams of HCl is neutralized in the same calorimeter, the temperature increased by 7.3 °C. What is the ΔH of neutralization of HCl in units of kJ/mol?

a) -177 kJ/mol

b) 0.486 kJ/mol

c) 1.8×10^2 kJ/mol

d) -486 kJ/mol

e) 177 kJ/mol

14. Given that:

$S(s) + O_2(g) \longrightarrow SO_2(g)$; $\Delta H = -296.8$ kJ/mol
$2\ SO_3(g) \longrightarrow 2\ SO_2(g) + O_2(g)$; $\Delta H = +197.8$ kJ/mol
Determine the enthalpy change of the reaction: $2\ S(s) + 3\ O_2(g) \rightarrow 2\ SO_3(g)$

a) -99 kJ/mol

b) 99 kJ/mol

c) 495 kJ/mol

d) -495 kJ/mol

e) -791.4 kJ/mol

15. At elevated temperatures, dinitrogen pentoxide decomposes to nitrogen dioxide and oxygen:
$2N_2O_5\ (g) \longrightarrow 4NO_2\ (g) + O_2\ (g)$
When the rate of formation of O_2 is 2.2×10^{-4} M/s, the rate of decomposition of N_2O_5 is _____ M/s.

A) 1.1×10^{-4}
B) 2.2×10^{-4}
C) 2.8×10^{-4}
D) 4.4×10^{-4}
E) 5.5×10^{-4}

16. How many isomers are possible for C_5H_{12}?

A) 1
B) 2
C) 3
D) 4
E) 10

17. Which statement about addition reactions between alkenes and HBr is <u>false</u>?

A) The addition occurs at the double bond.
B) Bromine attacks the alkene carbon atom possessing a partial positive charge.

C) A hydrogen atom attaches to the alkene carbon atom possessing a partial negative charge.
D) The π bond breaks in the course of the reaction.
E) The proposed mechanism involves radicals.

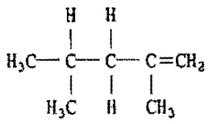
18. The simplest alkyne is _____.
A) ethylene
B) ethane
C) ethyne
D) propyne
E) benzene

19. The minimum number of carbons necessary for a hydrocarbon to form a branched structure is _____.
A) 4
B) 6
C) 3
D) 9
E) 12

20. The general formula of an alkane is _____.
A) $C_{2n}H_{2n+2}$
B) C_nH_{2n}
C) C_nH_{2n+2}
D) C_nH_{2n-2}
E) C_nH_n

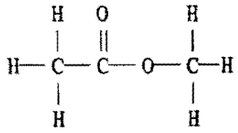
21. The compound below is an _____.
H-C=CH-CH_3
A) alkyne
B) alkene
C) alkane
D) aromatic compound
E) olefin

22. What is the name of the compound below?



A) 2,4-methylbutene
B) 2,5-dimethylpentane
C) 2,4-ethylbutene
D) 2,4-dimethyl-1-pentene
E) 2,4-dimethyl-4-pentene

23. The compound below is a(n) _____.



A) carboxylic acid
B) ketone
C) aldehyde
D) ester
E) amine

24. Which statement about hydrocarbons is false?

A) The smallest alkane to have structural (constitutional) isomers has 4 carbon atoms.
B) Cyclic alkanes are structural isomers of alkenes.
C) Alkanes are more reactive than alkenes.
D) Alkanes can be produced by hydrogenating alkenes.
E) Alkenes can be polymerized.

25. At equilibrium, _____.

A) All chemical reactions have ceased
B) The rates of the forward and reverse reactions are equal
C) The rate constants of the forward and reverse reactions are equal
D) The value of the equilibrium constant is 1
E) The limiting reagent has been consumed

26. Which one of the following is an endothermic process?

A) Ice melting
B) Water freezing
C) Boiling soup
D) Hydrochloric acid and barium hydroxide are mixed at 25 °C: the temperature increases.
E) Both A and C

27. Gaseous mixtures _____.

A) Can only contain molecules
B) Are all heterogeneous
C) Can only contain isolated atoms
D) Are all homogeneous
E) Must contain both isolated atoms and molecules

28. Which of the following expressions is the correct equilibrium-constant expression for the following reaction?

$CO_2\,(g) + 2H_2\,(g) \longrightarrow CH_3OH\,(g)$

A) $\dfrac{[CH_3OH]}{[CO_2]}$

B) $\dfrac{[CH_3OH]}{[CO_2][H_2]}$

C) $\dfrac{[CO_2][H_2]^2}{[CH_3OH]}$

D) $\dfrac{[CO_2][H_2]}{[CH_3OH]}$

E) $\dfrac{[CH_3OH]}{[CO_2][H_2]^2}$

29. Of the units below, _____ are appropriate for a first-order reaction rate constant.

A) $M\ s^{-1}$
B) s^{-1}
C) mol/L
D) $M^{-1}\ s^{-1}$
E) $L\ mol^{-1}\ s^{-1}$

30. Which of the following compounds do not contain an sp^3 hybridized oxygen atom?

A) Ketones
B) Alcohols
C) Ethers
D) Esters
E) Water

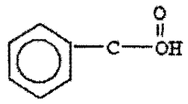
31. Which of the following is a statement of the first law of thermodynamics?
A) $E_k = (1/2)\ mv^2$
B) A negative ΔH corresponds to an exothermic process.
C) $\Delta E = E_{final} - E_{initial}$
D) Energy lost by the system must be gained by the surroundings.
E) 1 cal = 4.184 J (exactly)

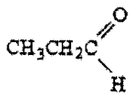
32. The rate law of a reaction is rate = k[D][X]. The units of the rate constant are _____.
A) $mol\ L^{-1}s^{-1}$
B) $L\ mol^{-1}s^{-1}$
C) $mol^2\ L^{-2}s^{-1}$
D) $mol\ L^{-1}s^{-2}$
E) $L^2\ mol^{-2}s^{-1}$

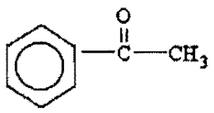
33. "Isothermal" means _____.
A) At constant pressure
B) At constant temperature
C) At variable temperature and pressure conditions
D) At ideal temperature and pressure conditions
E) That $\Delta H_{rxn} = 0$

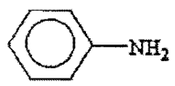
34. Which structure below represents a ketone?

A) $CH_3CH_2—O—CH_2CH_3$

B) 

C) 

D) 

E) 

35. The K_{eq} for the equilibrium below is 7.52×10^{-2} at 480.0°C.

$$2Cl_2\ (g) + 2H_2O\ (g) \longrightarrow 4HCl\ (g) + O_2\ (g)$$

What is the value of K_{eq} at this temperature for the following reaction?

$$4HCl\ (g) + O_2\ (g) \longrightarrow 2Cl_2\ (g) + 2H_2O\ (g)$$

A) 0.0752
B) -0.0752
C) 13.3
D) 5.66×10^{-3}
E) 0.150

36. Under what condition(s) is the enthalpy change of a process equal to the amount of heat transferred into or out of the system?
(a) Temperature is constant
(b) Pressure is constant
(c) Volume is constant
A) a only
B) b only
C) c only

D) a and b
E) b and c

37. The rate law for a reaction is

rate = k [A][B]^2

Which one of the following statements is false?

A) The reaction is first order in A.
B) The reaction is second order in B.
C) The reaction is second order overall.
D) k is the reaction rate constant
E) If [B] is doubled, the reaction rate will increase by a factor of 4.

38. Which of the following expressions is the correct equilibrium-constant expression for the reaction below?

CO_2 (s) + H_2O (l) ⟶ H^+ (aq) + HCO_3^- (aq)

A) $[H^+][HCO_3^-] / [CO_2]$
B) $[CO_2] / [H^+][HCO_3^-]$
C) $[H^+][HCO_3^-] / [CO_2][H_2O]$
D) $[CO_2][H_2O] / [H^+][HCO_3^-]$
E) $[H^+][HCO_3^-]$

38. Hydrocarbons containing carbon-carbon triple bonds are called _____.

A) Alkanes
B) Aromatic hydrocarbons
C) Alkynes
D) Alkenes
E) Olefins

39. Of the following, only _____ is impossible for an ideal gas.

A) $\frac{V_1}{T_1} = \frac{V_2}{T_2}$
B) $V_1T_1 = V_2T_2$
C) $\frac{V_1}{V_2} = \frac{T_1}{T_2}$
D) $V_2 = \frac{T_2}{T_1} V_1$
E) $\frac{V_1}{V_2} = \frac{T_1}{T_2} = 0$

40. Of the following equilibria, only _____ will shift to the left in response to a decrease in volume.

A) H_2 (g) + Cl_2 (g) ⟶ 2 HCl (g)
B) 2 SO_3 (g) ⟶ 2 SO_2 (g) + O_2 (g)
C) N_2 (g) + 3 H_2 (g) ⟶ 2 NH_3 (g)
D) 4 Fe (s) + 3 O_2 (g) ⟶ 2 Fe_2O_3 (s)
E) 2HI (g) ⟶ H_2 (g) + I_2 (g)

41. The reaction

CH_3-N≡C → CH_3-C≡N

is a first-order reaction. At 230.3 °C, k = 6.29 × $10^{-4}s^{-1}$. If [CH_3-N≡C] is 1.00 × 10^{-3} initially, [CH_3-N≡C] is _____ after 1.000 × 10^3 s.

A) 5.33×10^{-4}

B) 2.34×10^{-4}

C) 1.88×10^{-3}

D) 4.27×10^{-3}

E) 1.00×10^{-6}

42. In which of the following reactions would increasing pressure at constant temperature not change the concentrations of reactants and products, based on Le Châtelier's principle?

A) $N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$

B) $N_2O_4(g) \longrightarrow 2NO_2(g)$

C) $N_2(g) + 2O_2(g) \longrightarrow 2NO_2(g)$

D) $2N_2(g) + O_2(g) \longrightarrow 2N_2O(g)$

E) $N_2(g) + O_2(g) \longrightarrow 2NO(g)$

43. The general formula of an alkene is _____.

A) $C_{2n}H_{2n+2}$

B) C_nH_{2n}

C) C_nH_{2n+2}

D) C_nH_{2n-2}

E) C_nH_n

44. Which of the following is a statement of Hess's law?

A) If a reaction is carried out in a series of steps, the ΔH for the reaction will equal the sum of the enthalpy changes for the individual steps.

B) If a reaction is carried out in a series of steps, the ΔH for the reaction will equal the product of the enthalpy changes for the individual steps.

C) The ΔH for a process in the forward direction is equal in magnitude and opposite in sign to the ΔH for the process in the reverse direction.

D) The ΔH for a process in the forward direction is equal to the ΔH for the process in the reverse direction.

E) The ΔH of a reaction depends on the physical states of the reactants and products.

The reaction A → B *is first order in* [A]. *Consider the following data.*

time (s)	[A] (M)
0.0	1.60
10.0	0.40
20.0	0.10

45. The rate constant for this reaction is _____ s^{-1}.

A) 0.013

B) 0.030

C) 0.14

D) 3.0

E) 3.1×10^{-3}

46. Sodium bicarbonate is reacted with concentrated hydrochloric acid at 37.0°C and 1.00 atm. The reaction of 6.00 kg of bicarbonate with excess hydrochloric acid under these conditions will produce _____ L of CO_2.

A) 1.09×10^2

B) 2.85×10^4

C) 1.82×10^4

D) 8.70×10^2

E) 1.82×10^3

47. Consider the following two reactions:

$A \rightarrow 2B \quad \Delta H°_{rxn} = 456.7$ kJ/mol

$A \rightarrow C \quad \Delta H°_{rxn} = -22.1$kJ/mol

Determine the enthalpy change for the process:

$2B \rightarrow C$

A) -478.8 kJ/mol

B) -434.6 kJ/mol

C) 434.6 kJ/mol

D) 478.8 kJ/mol

E) More information is needed to solve the problem.

48. As the temperature of a reaction is increased, the rate of the reaction increases because the _____.

A) Reactant molecules collide less frequently

B) Reactant molecules collide more frequently and with greater energy per collision

C) Activation energy is lowered

D) Reactant molecules collide less frequently <u>and</u> with greater energy per collision

E) Reactant molecules collide more frequently with less energy per collision

49. The kinetic-molecular theory predicts that pressure rises as the temperature of a gas increases because _____.

A) The average kinetic energy of the gas molecules decreases

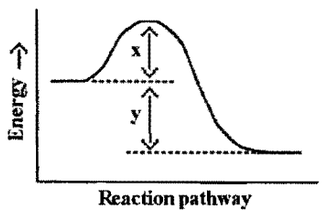
B) The gas molecules collide more frequently with the wall

C) The gas molecules collide less frequently with the wall

D) The gas molecules collide more energetically with the wall

E) Both the gas molecules collide more frequently with the wall <u>and</u> the gas molecules collide more energetically with the wall

50. Which energy difference in the energy profile below corresponds to the activation energy for the forward reaction?



A) x

B) y

C) x + y

D) x - y

E) y - x

Section B

Question 1

a. The temperature of a sample of an ideal gas in a sealed 5.0 L container is raised from 27 °C to 77 °C. If the initial pressure of the gas was 3.0 atm, what is the final pressure? (3)

b. A 0.614 mole sample of ideal gas at 12 °C occupies a volume of 4.3 L. What is the pressure of the gas? (3)

c. A solution is made by mixing 15.3 mL of 0.25 M HCl and 17.0 mL of 0.33 M NaOH. Calculate the pH of this solution. (6)

d. Given the data in the table below, calculate ΔH°_{rxn} for the reaction (10)

$Ca(OH)_2 + 2H_3AsO_4 \longrightarrow Ca(H_2AsO_4)_2 + 2H_2O.$

Substance	ΔH°_f (kJ/mol)
$Ca(OH)_2$	-986.6
H_3AsO_4	-900.4
$Ca(H_2AsO_4)_2$	-2346.0
H_2O	-285.9

e. For the reaction:

$$H_2(g) + I_2(g) \rightleftharpoons 2\,HI(g)$$

K_p = 794 at 298 K and K_p = 55 at 700 K. Is the formation of HI favored more at the higher or lower temperature? (3)

Question 2

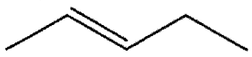
a) Define the following terms: (4)

i. Saturated hydrocarbon

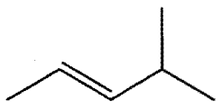
ii. Unsaturated hydrocarbon

b) Give the IUPAC names of: (12)

i.



ii.



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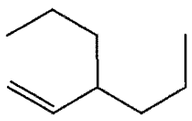
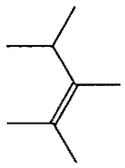
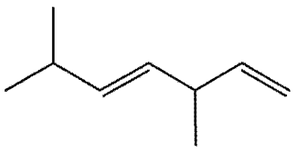
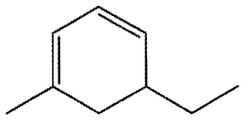


iv.



v. 

vi. 

c) Derive all possible isomers of: (6)

i. C_3H_8

ii. C_4H_{10}

iii. C_5H_{12}

d) Write the structural formula of the following incorrect IUPAC name (2-methylcyclohexene) and give the correct name. (3)

Question 3

a. Write the equilibrium-constant expressions for the following reactions: (4)

i) K_c for $Cr(s) + 3\,Ag^+(aq) \rightleftharpoons Cr^{3+}(aq) + 3\,Ag(s)$

ii) K_p for $3\,Fe(s) + 4\,H_2O(g) \rightleftharpoons Fe_3O_4(s) + 4\,H_2(g)$

b. Nitrous oxide can be formed by thermal decomposition of ammonium nitrate.

$$NH_4NO_{3(s)} \longrightarrow N_2O_{(g)} + 2H_2O_{(g)}$$

What mass of ammonium nitrate would be required to produce 115 L of N_2O at 2800 Torr and 42°C (3)

c. (i) State Dalton's law of partial pressures. (2)

(ii) At 25°C, 0.300 moles of $CH_{4(g)}$, 0.200 mole of $H_{2(g)}$ and 0.400 mole of $N_{2(g)}$ are contained in a 10.0 L flask. Evaluate the partial pressure (in atm), of each of the components of the gaseous mixture in the flask, and the overall pressure in the flask. (5)

(iii) Suppose the temperature of the flask above is raised from 25°C to 75°C, evaluate the ratio of the total pressures in the flask at the two temperatures. (3)

(iv) Calculate the volume of 0.65 mole of an ideal gas at 499 Torr and 102°C (3)
(NB: use R = 0.0821 L.atm.mol^{-1}K^{-1})

d. Tennis balls are usually filled with either air or N_2 gas to a pressure above atmospheric pressure to increase their bounce. If a tennis ball has a volume of 144 cm^3 and contains 0.33 g of N_2 gas, what is the pressure inside the ball at 24 °C? (5)

General data and fundamental constants

Quantity	Symbol	Value
Speed of light	c	$2.997\,924\,58 \times 10^{8}$ m s^{-1}
Elementary charge	e	$1.602\,177 \times 10^{-19}$ C
Faraday constant	$F = N_A e$	9.6485×10^{4} C mol^{-1}
Boltzmann constant	k	$1.380\,66 \times 10^{-23}$ J K^{-1}
Gas constant	$R = N_A k$	8.314 51 J K^{-1} mol^{-1}
		$8.205\,78 \times 10^{-2}$ dm^3 atm K^{-1} mol^{-1}
		6.2364×10 L Torr K^{-1} mol^{-1}
Planck constant	h	$6.626\,08 \times 10^{-34}$ J s
	$\hbar = h/2\pi$	$1.054\,57 \times 10^{-34}$ J s
Avogadro constant	N_A	$6.022\,14 \times 10^{23}$ mol^{-1}
Atomic mass unit	u	$1.660\,54 \times 10^{-27}$ Kg
Mass		
electron	m_e	$9.109\,39 \times 10^{-31}$ Kg
proton	m_p	$1.672\,62 \times 10^{-27}$ Kg
neutron	m_n	$1.674\,93 \times 10^{-27}$ Kg
Vacuum permittivity	$\varepsilon_0 = 1/c^2\mu_0$	$8.854\,19 \times 10^{-12}$ J^{-1} C^2 m^{-1}
	$4\pi\varepsilon_0$	$1.112\,65 \times 10^{-10}$ J^{-1} C^2 m^{-1}
Vacuum permeability	μ_0	$4\pi \times 10^{-7}$ J s^2 C^{-2} m^{-1}
		$4\pi \times 10^{-7}$ T^2 J^{-1} m^3
Magneton		
Bohr	$\mu_B = e\hbar/2m_e$	$9.274\,02 \times 10^{-24}$ J T^{-1}
nuclear	$\mu_N = e\hbar/2m_p$	$5.050\,79 \times 10^{-27}$ J T^{-1}
g value	g_e	2.002 32
Bohr radius	$a_0 = 4\pi\varepsilon_0\hbar/m_e e^2$	$5.291\,77 \times 10^{-11}$ m
Fine-structure constant	$\alpha = \mu_0 e^2 c/2h$	$7.297\,35 \times 10^{-3}$
Rydberg constant	$R_\infty = m_e e^4/8h^3 c\varepsilon_0^2$	$1.097\,37 \times 10^{7}$ m^{-1}
Standard acceleration of free fall	g	9.806 65 m s^{-2}
Gravitational constant	G	$6.672\,59 \times 10^{-11}$ N m^2 Kg^{-2}

Conversion factors

1 cal	=	4.184 joules (J)	1 erg	=	1×10^{-7} J
1 eV	=	$1.602\,2 \times 10^{-19}$ J	1 eV/molecule	=	96 485 kJ mol^{-1}

Prefixes

f	p	n	μ	m	c	d	k	M	G
femto	pico	nano	micro	milli	centi	deci	kilo	mega	giga
10^{-15}	10^{-12}	10^{-9}	10^{-6}	10^{-3}	10^{-2}	10^{-1}	10^{3}	10^{6}	10^{9}

PERIODIC TABLE OF ELEMENTS

PERIODS	GROUPS 1 IA	2 IIA	3 IIIB	4 IVB	5 VB	6 VIB	7 VIIB	8	9	10 VIIIB	11 IB	12 IIB	13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA	18 VIIIA
1	1.008 **H** 1																	4.003 **He** 2
2	6.941 **Li** 3	9.012 **Be** 4											10.811 **B** 5	12.011 **C** 6	14.007 **N** 7	15.999 **O** 8	18.998 **F** 9	20.180 **Ne** 10
3	22.990 **Na** 11	24.305 **Mg** 12											26.982 **Al** 13	28.086 **Si** 14	30.974 **P** 15	32.06 **S** 16	35.453 **Cl** 17	39.948 **Ar** 18
4	39.098 **K** 19	40.078 **Ca** 20	44.956 **Sc** 21	47.88 **Ti** 22	50.942 **V** 23	51.996 **Cr** 24	54.938 **Mn** 25	55.847 **Fe** 26	58.933 **Co** 27	58.69 **Ni** 28	63.546 **Cu** 29	65.39 **Zn** 30	69.723 **Ga** 31	72.61 **Ge** 32	74.922 **As** 33	78.96 **Se** 34	79.904 **Br** 35	83.80 **Kr** 36
5	85.468 **Rb** 37	87.62 **Sr** 38	88.906 **Y** 39	91.224 **Zr** 40	92.906 **Nb** 41	95.94 **Mo** 42	98.907 **Tc** 43	101.07 **Ru** 44	102.91 **Rh** 45	106.42 **Pd** 46	107.87 **Ag** 47	112.41 **Cd** 48	114.82 **In** 49	118.71 **Sn** 50	121.75 **Sb** 51	127.60 **Te** 52	126.90 **I** 53	131.29 **Xe** 54
6	132.91 **Cs** 55	137.33 **Ba** 56	138.91 ***La** 57	178.49 **Hf** 72	180.95 **Ta** 73	183.85 **W** 74	186.21 **Re** 75	190.2 **Os** 76	192.22 **Ir** 77	195.08 **Pt** 78	196.97 **Au** 79	200.59 **Hg** 80	204.38 **Tl** 81	207.2 **Pb** 82	208.98 **Bi** 83	(209) **Po** 84	(210) **At** 85	(222) **Rn** 86
7	223 **Fr** 87	226.03 **Ra** 88	(227) ****Ac** 89	(261) **Rf** 104	(262) **Ha** 105	(263) **Unh** 106	(262) **Uns** 107	(265) **Uno** 108	(266) **Une** 109	(267) **Uun** 110								

TRANSITION ELEMENTS

Atomic mass → 10.811
Symbol → **B**
Atomic No. → 5

***Lanthanide Series**	140.12 **Ce** 58	140.91 **Pr** 59	144.24 **Nd** 60	(145) **Pm** 61	150.36 **Sm** 62	151.96 **Eu** 63	157.25 **Gd** 64	158.93 **Tb** 65	162.50 **Dy** 66	164.93 **Ho** 67	167.26 **Er** 68	168.93 **Tm** 69	173.04 **Yb** 70	174.97 **Lu** 71
****Actinide Series**	232.04 **Th** 90	231.04 **Pa** 91	238.03 **U** 92	237.05 **Np** 93	(244) **Pu** 94	(243) **Am** 95	(247) **Cm** 96	(247) **Bk** 97	(251) **Cf** 98	(252) **Es** 99	(257) **Fm** 100	(258) **Md** 101	(259) **No** 102	(260) **Lr** 103

( ) indicates the mass number of the isotope with the longest half-life.

UNIVERSITY OF SWAZILAND

CHEMISTRY DEPARTMENT

C112 SECTION A ANSWER SHEET

STUDENT ID NUMBER:_____

The correct answer must be indicated by putting a circle on the letter for that answer on the answer sheet provided. If you change your answer, please cancel the wrong answer with a cross and then put a circle around the correct one. If more than one option has a circle around it a zero will be given for that question.

1	A	B	C	D	E
2	A	B	C	D	E
3	A	B	C	D	E
4	A	B	C	D	E
5	A	B	C	D	E
6	A	B	C	D	E
7	A	B	C	D	E
8	A	B	C	D	E
9	A	B	C	D	E
10	A	B	C	D	E
11	A	B	C	D	E
12	A	B	C	D	E
13	A	B	C	D	E
14	A	B	C	D	E
15	A	B	C	D	E
16	A	B	C	D	E
17	A	B	C	D	E
18	A	B	C	D	E
19	A	B	C	D	E
20	A	B	C	D	E
21	A	B	C	D	E
22	A	B	C	D	E
23	A	B	C	D	E
24	A	B	C	D	E
25	A	B	C	D	E

26	A	B	C	D	E
27	A	B	C	D	E
28	A	B	C	D	E
29	A	B	C	D	E
30	A	B	C	D	E
31	A	B	C	D	E
32	A	B	C	D	E
33	A	B	C	D	E
34	A	B	C	D	E
35	A	B	C	D	E
36	A	B	C	D	E
37	A	B	C	D	E
38	A	B	C	D	E
39	A	B	C	D	E
40	A	B	C	D	E
41	A	B	C	D	E
42	A	B	C	D	E
43	A	B	C	D	E
44	A	B	C	D	E
45	A	B	C	D	E
46	A	B	C	D	E
47	A	B	C	D	E
48	A	B	C	D	E
49	A	B	C	D	E
50	A	B	C	D	E