UNIVERSITY COLLEGE TATI

UNIVERSITY COLLEGE TATI (UC TATI)

FINAL EXAMINATION QUESTION BOOKLET

COURSE CODE	: DTC 1043
COURSE	: PHYSICAL AND ORGANIC CHEMISTRY
SEMESTER/SESSION	: 1 - 2024/2025
DURATION	: 3 HOURS

Instructions:

1. This booklet contains 4 questions. Answer **ALL** questions.
2. All answers should be written in answer booklet.
3. Write legibly and draw sketches wherever required.
4. If in doubt, raise up your hands and ask the invigilator.

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

THIS BOOKLET CONTAINS 6 PRINTED PAGES INCLUDING COVER PAGE

QUESTION 1

(a) Identify the following as either element or compound? Refer to the list of elements inside if necessary. (7 marks)

(i) Carbon monoxide
(ii) Hydrogen
(iii) Iron
(iv) Titanium
(v) Potassium
(vi) Sodium bicarbonate
(viii) Sulphate

(b) Carry out factors affecting reaction rates. (12 marks)

(c) Compute each of the following into atmospheres (atm). (2 marks)

(i) 77.00 mmHg
(ii) 800.0 torr

(d) A 3000 cm^3 vessel consists of 12 g carbon monoxide at 27°C. (6 marks)

(i) Calculate the pressure of the gas.
(ii) 1.929 moles of oxygen gas is added to the vessel at the same temperature. Calculate the pressure in the vessel.
(iii) The mixture is now sparked and allowed to cool down to 27°C. Determine the final pressure in the vessel. (C=12.0, O = 16.0)

QUESTION 2

(a) In a kinetic study of the reaction: (10 marks)

$2NO(g) + O_2(g) \rightarrow 2NO_2(g)$

The following data were obtained for the initial rates disappearance of NO:

Experiment	Initial conc. NO	Initial conc. O_2	Intial rate of NO
1	0.0125 M	0.0253 M	0.0281M/s
2	0.0250 M	0.0253 M	0.112 M/s
3	0.0125 M	0.0506 M	0.0561M/s

Compute the rate law and the value of the rates constant.

(b) Determination of rate order and write the rate law from an experiment, for the following reaction. (10 marks)

$2A + B \rightarrow C$

The following data is obtained at 273°C.

Experiment	$[A]_o$, mol/L	$[B]_o$; mol/L	r_o, initial rate, mol/L.s
1	0.1	0.1	12
2	0.1	0.2	24
3	0.1	0.3	36
4	0.2	0.1	48
5	0.3	0.1	108

(c) Describe what is meant by the rate of chemical reaction and give units of the rate reaction? (3 marks)

QUESTION 3

(a) Consider the following thermochemical equations: (6 marks)

$C\ (s) + \frac{1}{2}\ O_2\ (g)\ ) \rightarrow CO\ (g)$ $\Delta H_1^o = -110.5kJ$

$CO\ (g) + O_2\ (g) \rightarrow CO_2$ $\Delta H_2^o = -283.0kJ$

Use them to calculate ΔH^o for the reaction.

$C\ (s) + O_2\ (g) \rightarrow CO_2\ (g)$

(b) Define : (3 marks)

(i) Exothermic reaction

(ii) Endothermic reaction

(iii) Enthalpy change

(c) Sketch the structure formula and classify the functional group for each formula below: (8 marks)

(i) Butane

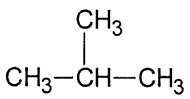
(ii) 2-propanol

(iii) 2-methylpropene

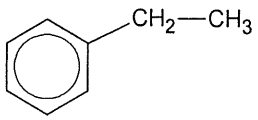
(iv) Cyclopentene

(d) Complete the nomenclature of structure formula below: (4 marks)

(i)



(ii)



QUESTION 4

(a) For the following voltaic cell reaction (at standard condition, Zn & Cu as the electrodes in their respective ionic solution) : (11 marks)

$Zn(s) + Cu^{2+}\ (aq) \rightarrow Zn^{2+}\ (aq) + Cu(s)$

(i) Sketch the schematic diagram for the voltaic cell

(ii) Which reaction takes place at anode and which at the cathode?

(iii) What is the total reaction?

(b) Give the oxidation number of atoms in molecules or ion below:- (3 marks)

(i) S in H_2SO_4

(ii) As in AsO_4^{3-}

(iii) S in $H_2S_2O_8$

(c) Calculate the cell potential (E_{cell}) when the concentrations are (at 25°C) : (3 marks)
$[Zn^{2+}]$ = 0.020 M, $[Cu^{2+}]$ = 0.004 M.

$$E = E^0 - \frac{0.0592}{n} \log Q_c$$

(d) Identify each of the following half reactions as either oxidation or reduction. (10 marks)

(i) $Na \rightarrow Na^+ + e^-$

(ii) $Zn^{2+} + 2e^- \rightarrow Zn$

(iii) $Fe^{2+} \rightarrow Fe^{3+} + e^-$

(iv) $O_2 + 4H^+ + 4e^- \rightarrow 2H_2O$

(v) $S_2O_8^{2-} + 2e^- \rightarrow 2SO_4^{2-}$

----------End of question----------

THE PERIODIC TABLE

1 IA	2 IIA	3 IIIB	4 IVB	5 VB	6 VIB	7 VIIB	8	9 VIIIB	10	11 IB	12 IIB	13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA	18 VIIIA
H 1 1.008 Hydrogen																	**He** 2 4.00 Helium
Li 3 6.94 Lithium	**Be** 4 9.01 Beryllium											**B** 5 10.81 Boron	**C** 6 12.01 Carbon	**N** 7 14.01 Nitrogen	**O** 8 16.00 Oxygen	**F** 9 19.00 Fluorine	**Ne** 10 20.18 Neon
Na 11 22.99 Sodium	**Mg** 12 24.31 Magnesium											**Al** 13 26.98 Aluminum	**Si** 14 28.09 Silicon	**P** 15 30.97 Phosphorus	**S** 16 32.07 Sulfur	**Cl** 17 35.45 Chlorine	**Ar** 18 39.95 Argon
K 19 39.10 Potassium	**Ca** 20 40.08 Calcium	**Sc** 21 44.96 Scandium	**Ti** 22 47.88 Titanium	**V** 23 50.94 Vanadium	**Cr** 24 52.00 Chromium	**Mn** 25 54.94 Manganese	**Fe** 26 55.85 Iron	**Co** 27 58.93 Cobalt	**Ni** 28 58.69 Nickel	**Cu** 29 63.55 Copper	**Zn** 30 65.39 Zinc	**Ga** 31 69.72 Gallium	**Ge** 32 72.61 Germanium	**As** 33 74.92 Arsenic	**Se** 34 78.96 Selenium	**Br** 35 79.90 Bromine	**Kr** 36 83.80 Krypton
Rb 37 85.47 Rubidium	**Sr** 38 87.62 Strontium	**Y** 39 88.91 Yttrium	**Zr** 40 91.22 Zirconium	**Nb** 41 92.91 Niobium	**Mo** 42 95.94 Molybdenum	**Tc** 43 (97.9) Technetium	**Ru** 44 101.07 Ruthenium	**Rh** 45 102.91 Rhodium	**Pd** 46 106.42 Palladium	**Ag** 47 107.87 Silver	**Cd** 48 112.41 Cadmium	**In** 49 114.82 Indium	**Sn** 50 118.71 Tin	**Sb** 51 121.76 Antimony	**Te** 52 127.60 Tellurium	**I** 53 126.90 Iodine	**Xe** 54 131.29 Xenon
Cs 55 132.91 Cesium	**Ba** 56 137.33 Barium	**La** 57 138.91 Lanthanum	**Hf** 72 178.49 Hafnium	**Ta** 73 180.95 Tantalum	**W** 74 183.85 Tungsten	**Re** 75 186.21 Rhenium	**Os** 76 190.2 Osmium	**Ir** 77 192.22 Iridium	**Pt** 78 195.08 Platinum	**Au** 79 196.97 Gold	**Hg** 80 200.59 Mercury	**Tl** 81 204.38 Thallium	**Pb** 82 207.2 Lead	**Bi** 83 208.98 Bismuth	**Po** 84 (209) Polonium	**At** 85 (210) Astatine	**Rn** 86 (222) Radon
Fr 87 223.02 Francium	**Ra** 88 226.03 Radium	**Ac** 89 227.03 Actinium	**Rf** 104 (261) Rutherfordium	**Db** 105 (262) Dubnium	**Sg** 106 (263) Seaborgium	**Bh** 107 (262) Bohrium	**Hs** 108 (265) Hassium	**Mt** 109 (266) Meitnerium	Unnamed Discovery 110 Nov. 1994	Unnamed Discovery 111 Nov. 1994	Unnamed Discovery 112 1996		Unnamed Discovery 114 1999		Unnamed Discovery 116 1999		Unnamed Discovery 118 1999
ALKALI METALS	ALKALI EARTH METALS															HALOGENS	NOBLE GASES

H — 1 — 1.008 — Hydrogen: SYMBOL; ATOMIC NUMBER; ATOMIC WEIGHT; NAME

( ) = ESTIMATES

LANTHANIDES	**Ce** 58 140.12 Cerium	**Pr** 59 140.91 Praseodymium	**Nd** 60 144.24 Neodymium	**Pm** 61 (145) Promethium	**Sm** 62 150.36 Samarium	**Eu** 63 152.97 Europium	**Gd** 64 157.25 Gadolinium	**Tb** 65 158.93 Terbium	**Dy** 66 162.50 Dysprosium	**Ho** 67 164.93 Holmium	**Er** 68 167.26 Erbium	**Tm** 69 168.93 Thulium	**Yb** 70 173.04 Ytterbium	**Lu** 71 174.97 Lutetium
ACTINIDES	**Th** 90 232.04 Thorium	**Pa** 91 231.04 Protactinium	**U** 92 238.03 Uranium	**Np** 93 237.05 Neptunium	**Pu** 94 (240) Plutonium	**Am** 95 243.06 Americium	**Cm** 96 (247) Curium	**Bk** 97 (248) Berkelium	**Cf** 98 (251) Californium	**Es** 99 252.08 Einsteinium	**Fm** 100 257.10 Fermium	**Md** 101 (257) Mendelevium	**No** 102 259.10 Nobelium	**Lr** 103 262.11 Lawrencium

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