



ZIMBABWE

**MINISTRY OF HIGHER AND TERTIARY EDUCATION,
INNOVATION, SCIENCE AND TECHNOLOGY DEVELOPMENT**

**HIGHER EDUCATION EXAMINATIONS COUNCIL
(HEXCO)**

NATIONAL CERTIFICATE

IN

LABORATORY TECHNOLOGY

MODULE: Laboratory Sample Processing 1 PAPER NO: 360/24/M02

DURATION: 3 Hours

NOVEMBER/DECEMBER 2025 EXAMINATION

REQUIREMENTS

INSTRUCTIONS TO CANDIDATE

1. Section A:(40 marks)-Answer all questions.
2. Section B:(60 marks)-Answer any three (3) questions.
3. Each question carries 20 marks.
4. Periodic table is attached at the back.

SECTION A

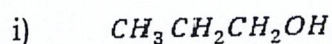
QUESTION 1

- a) Define the following terms
- i) Relative atomic mass
 - ii) Isotopes
 - iii) Electronegativity
 - iv) Primary standard
 - v) Functional group (10 marks)
- b) Compare ionic and covalent bonding providing one example for each. (4 marks)
- c) State the electronic configuration for:
- i) Na (1 mark)
 - ii) Cl (1 mark)
- d) Draw the Lewis structure for CO_2 (4 marks)

QUESTION 2

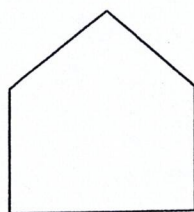
- a)
- i) A compound contains 40% sulphur, 60% of oxygen by mass. Determine its empirical formula. (6 marks)
 - ii) The molar mass of the compound in (i) is 160g/mol. Determine its molecular formula. (4 marks)
- b) State the functional groups for:
- i) Alkanes
 - ii) Alkenes
 - iii) Ethers (6 marks)

c) Name the following organic compounds

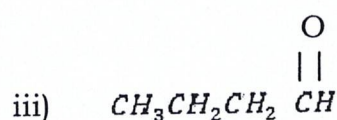


(1 mark)

ii)



(2 marks)



(1 mark)

SECTION B

QUESTION 3

A laboratory technician is tasked with processing a bulk environmental sample for chemical and biological analysis.

- a) Explain the importance of proper sampling techniques in ensuring the accuracy and reliability of chemical and biological analysis. (4 marks)
- b) Describe three different sampling tools used for chemical and biological sample collection. (6 marks)
- c) Compare coning and quartering with thermal size reduction. (6 marks)
- d) Briefly discuss the role of reagent used in sample decomposition. (4 marks)

QUESTION 4

- a) Define the term extraction. (3 marks)
- b) Describe the following extraction methods (15 marks)
 - i) Maceration
 - ii) Ultrasonic extraction
 - iii) Soxhlet extraction

- c) Name two (2) analytical techniques used to examine extracted samples. (2 marks)

QUESTION 5

A 100ml water sample is analysed for its chloride concentration. The water is treated with an excess of silver nitrate ($AgNO_3$) which reacts with chloride ions to form a white precipitate of silver chloride ($AgCl$). After the reaction, the $AgCl$ precipitate is filtered, dried and weighed, yielding a mass of 1.70g.

- a) Write the balanced chemical equation for the reaction between chloride ions and silver nitrate. (2 marks)
- b) Calculate the number of moles of $AgCl$ formed. (4 marks)
- c) Determine the number of moles of chloride ions in the water Sample. (4 marks)
- d) Calculate the concentration of chloride ions in the water sample in mg/L. (6 marks)
- e) Suggest one possible source of error in this procedure and briefly explain how it might affect results. (4 marks)

QUESTION 6

Describe the principles and application of the following analytical techniques.

- a) Ultraviolet- Visible Spectroscopy (UV-VIS) (10 marks)
- b) Thin layer chromatography (TLC) (10 marks)

The Periodic Table of Elements

1		2		Group																		13		14		15		16		17		18					
				Key												1 H hydrogen 1.0																				2 He helium 4.0	
				atomic number atomic symbol name relative atomic mass																																	
3	Li lithium 6.9	4	Be beryllium 9.0													5	B boron 10.8	6	C carbon 12.0	7	N nitrogen 14.0	8	O oxygen 16.0	9	F fluorine 19.0	10	Ne neon 20.2										
11	Na sodium 23.0	12	Mg magnesium 24.3	3	4	5	6	7	8	9	10	11	12	13	Al aluminium 27.0	14	Si silicon 28.1	15	P phosphorus 31.0	16	S sulfur 32.1	17	Cl chlorine 35.5	18	Ar argon 39.9												
19	K potassium 39.1	20	Ca calcium 40.1	21	Sc scandium 45.0	22	Ti titanium 47.9	23	V vanadium 50.9	24	Cr chromium 52.0	25	Mn manganese 54.9	26	Fe iron 55.8	27	Co cobalt 58.9	28	Ni nickel 58.7	29	Cu copper 63.5	30	Zn zinc 65.4	31	Ga gallium 69.7	32	Ge germanium 72.6	33	As arsenic 74.9	34	Se selenium 79.0	35	Br bromine 79.9	36	Kr krypton 83.8		
37	Rb rubidium 85.5	38	Sr strontium 87.6	39	Y yttrium 88.9	40	Zr zirconium 91.2	41	Nb niobium 92.9	42	Mo molybdenum 95.9	43	Tc technetium -	44	Ru ruthenium 101.1	45	Rh rhodium 102.9	46	Pd palladium 106.4	47	Ag silver 107.9	48	Cd cadmium 112.4	49	In indium 114.8	50	Sn tin 116.7	51	Sb antimony 121.8	52	Te tellurium 127.6	53	I iodine 126.9	54	Xe xenon 131.3		
55	Cs cesium 132.9	56	Ba barium 137.3	57-71 lanthanoids		72	Hf hafnium 178.5	73	Ta tantalum 180.9	74	W tungsten 183.8	75	Re rhenium 186.2	76	Os osmium 190.2	77	Ir iridium 192.2	78	Pt platinum 195.1	79	Au gold 197.0	80	Hg mercury 200.6	81	Tl thallium 204.4	82	Pb lead 207.2	83	Bi bismuth 209.0	84	Po polonium -	85	At astatine -	86	Rn radon -		
87	Fr francium -	88	Ra radium -	89-103 actinoids		104	Rf rutherfordium -	105	Db dubnium -	106	Sg seaborgium -	107	Bh bohrium -	108	Hs hassium -	109	Mt meitnerium -	110	Ds darmstadtium -	111	Rg roentgenium -	112	Cr copernicium -			114	Fl flerovium -			116	Lv livermorium -						
lanthanoids				57	La lanthanum 138.9	58	Ce cerium 140.1	59	Pr praseodymium 140.9	60	Nd neodymium 144.4	61	Pm promethium -	62	Sm samarium 150.4	63	Eu europium 152.0	64	Gd gadolinium 157.3	65	Tb terbium 158.9	66	Dy dysprosium 162.5	67	Ho holmium 164.9	68	Er erbium 167.3	69	Tm thulium 168.9	70	Yb ytterbium 173.1	71	Lu lutetium 175.0				
actinoids				89	Ac actinium -	90	Th thorium 232.0	91	Pa protactinium 231.0	92	U uranium 238.0	93	Np neptunium -	94	Pu plutonium -	95	Am americium -	96	Cm curium -	97	Bk berkelium -	98	Cf californium -	99	Es einsteinium -	100	Fm fermium -	101	Md mendelevium -	102	No nobelium -	103	Lr lawrencium -				