UNEB UACE CHEMISTRY 2002

PAPER 1

SECTION A

Answer all questions in this section

1. Write an ionic for the reaction between sodium hydroxide and

a) Silicon (iv)oxide,
…….

b) Lead(ii)oxide,
……..

c) Aluminium(iii)oxide,
…….

2. The mass spectrum of chlorine shaows peaks at masses 70, 72, and 74. The heights of the peaks respectively are in the ratio of 9:6:1

Calculate:

a) The average atomic mass of chlorine
…….

b) The relative abundance of ^{35}Cl and ^{37}Cl.
……

3. Complete the following equations and in each case write a mechanism for the reaction.

4. The table below shows the ionization energies (in k mol^{-1}) of five elements lettered A, B, C, D, and E.

Element	1st ionization energy	2nd ionization energy	3rd ionization energy	4th ionization energy
A	500	4600	6900	9500
B	740	1500	7700	10500
C	630	1600	3000	4800
D	900	1800	14800	21000
E	580	1800	2700	11600

a) Which one of these elements is more likely to form an ion with a charge of + 1? Give reason for your answer.
……

b) State:

i. Two elements which belong to the same group in the periodic table.
……

ii. The group to which the elements you have stated in b(i) belong.
…….

C) i) Write the formula of the chloride of element E.
……

ii) Write equation for the reactions between the chloride of element E and water.
……

5. a) Derive the expression for the half-life for a first order reaction:

2.303 log **?** ; where a_o is the initial concentration of the reactant and (a_o-x) is the concentration at time, *t.* ……..

b) The half-life of a first order reaction is 100s.

i. Calculate the rate constant.
……..

ii. Determine the percentage of the reactant that reacted after 250s.
……

6. Show how the following conversions could be carried out. ?

7. a) One of the properties of transition metals is complex ion formation

i. Define the term 'complex ion'

ii. Explain why transition metals form many complexes.

c) $Fe(CN)_6^{3-}$ and $(CuCl_4)^{2-}$ are complexes formed by iron and copper respectively.

State:

(i) The oxidation state of:

Iron ……

Copper ……..

(ii) The co-ordination number of:

Iron ……

Copper ……

8. (a) Define the term 'partial pressure'.

(b) The vapour pressures of pure chloroform and carbon tetrachloride are 199.1 and 114.5mmHg respectively at 25^oC. (Assume that a mixture of the two liquids behave as an ideal gas and that it contains 0.96 mole of each pure liquid.)

Calculate:

(i) The partial pressure of each component in the mixture. .....

(ii) The total pressure. .....

(c) Calculate the percentage of carbon tetrachloride in the vapour in equilibrium with the liquid mixture. .....

9. Complete the following equations and write the IUPAC name of the major organic product. ?

SECTION B

Answer only six questions from this section

10. State what would be observed and write equations for the reactions that take place when the following compounds are reacted.

a) Aqueous potassium dichromate (VI) with hydrogen sulphide.
……..

b) Aqueous iron(III) chloride with sodium carbonate.
……

c) Aqueous copper(II) sulphate with potassium iodide.
……

11. (a) An organic compound A contains carbon, hydrogen and oxygen only. On combustion, 0.463g of A gave 1.1g carbon dioxide and 0.563g of water. Determine the empirical formula of A. ……

(b) When vaporized, 0.1g of A occupies 54.5cm^3 at 208^{0}C and 98.3 Kp$_A$. Determine the molecular formula of A.
……..

(c) A reacts with sodium metal with evolution of a gas. Write the structural formulae of all possible isomers of A.
……

(d) A reacts with anhydrous Zinc chloride and concentrated hydrochloric acid to give a cloudy solution in about 5 minutes.

(i) Identify A. ……..

(ii) Show how A could be synthesized from but-2-nE.
……..

12. a) A piece of clean magnesium ribbon was added to a solution of iron(III) chloride solution.

i. State what was observed.
……

ii. Explain your observation in (a) (i) above.
……

iii. Write stepwise equations for the reactions that took place.
……

b) State what would be observed if a few drops of iron(III) chloride was added to the solution of the following:

(i) Sodium acetate.

(ii) Phenol

13. Complete the table below about the properties of different types of crystals.

Type of crystal	Force holding the crystals	Melting point (state whether low, moderate, high or very high)	Form in which electricity is conducted if any.
Metallic			
Ionic			
Network covalent			

14. a) Write equation to show how ethanol can be formed from glucose. ……..

c) Write equations to show how ethyne can be:

i. Prepard from ethanol
……

ii. Converted to methylpropyne
……

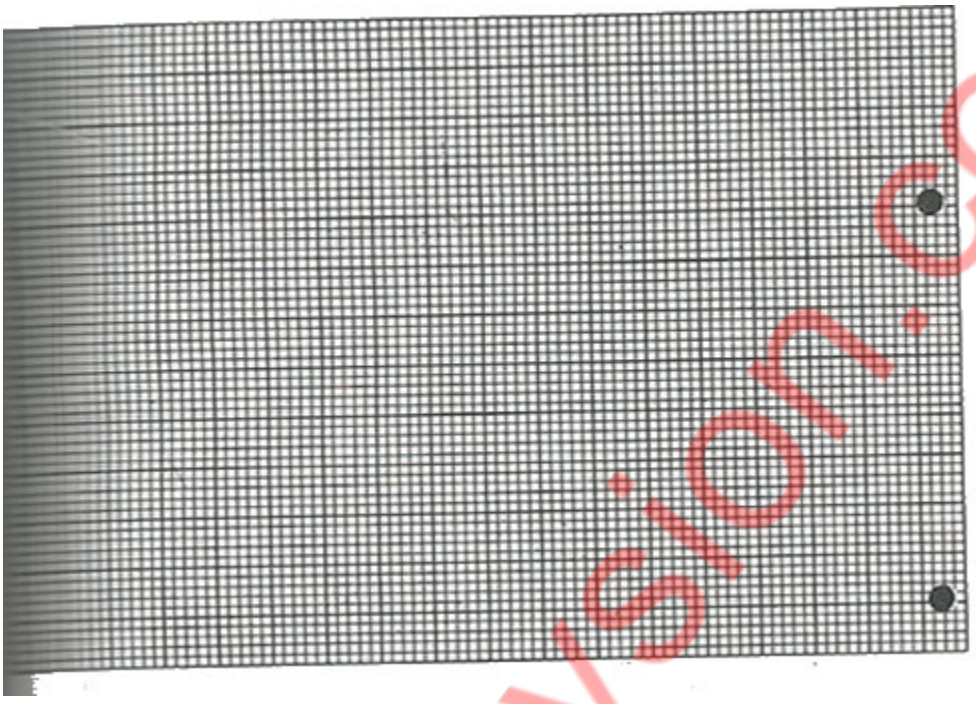
d) i) Name one reagent that can be used to confirm the formation of methylpropyne.
……

ii) State what would be observed if methylpropane was reacted with the reagent you have named in (c) (i) and write equation for the reaction.
……

15. a) The table below shows the atomic numbers of some elements and their electrons affinities.

Atomic no.	11	12	13	14	15	16	17
Electron affinity (kj mol^{-1})	2.0	-6.7	3.0	13.5	6.0	20.0	36.4

i) Draw a graph of electron affinity versus atomic number.



ii) Explain the shape of the graph.

b) List three factors which affect the size of the first ionization energy of an element.

16. Write equations to show how the following compounds can be synthesized.

(a) CH_3CHO (from 1, 2- dibromoethane).
……

(b) CH_3CO_2H (from iodomethane).
…….

(c) $CH_3CO_2CH_3$ (from ethane)
……

17. (a) Name two plants from which vegetable oil can be obtained. ……

(b) Soap was prepared from 9.5g of an oil containing mainly hexadecanoic acid $CH_3(CH_2)_{14}CO_2H$ as the main component of the oil.

(i) Explain briefly how pure soap was obtained from the oil.
……..

(ii) Write equation for the reaction leading to the formation of the soap.
……..

(iii) Calculate the mass of the soap formed.
…….

(d) Name one use of the residue left the oil has been extracted.
……..

THE PERIODIC TABLE

1	2											3	4	5	6	7	8
1.0 H 1																1.0 H 1	4.0 He 2
6.9 Li 3	9.0 Be 4											10.8 B 5	12.0 C 6	14.0 N 7	16.0 O 8	19.0 F 9	20.2 Ne 10
23.0 Na 11	24.3 Mg 12											27.0 Al 13	28.1 Si 14	31.0 P 15	32.1 S 16	35.4 Cl 17	40.0 Ar 18
39.1 K 19	40.1 Ca 20	45.0 Sc 21	47.9 Ti 22	50.9 V 23	52.0 Cr 24	54.9 Mn 25	55.8 Fe 26	58.9 Co 27	58.7 Ni 28	63.5 Cu 29	65.7 Zn 30	69.7 Ga 31	72.6 Ge 32	74.9 As 33	79.0 Se 34	79.9 Br 35	83.8 Kr 36
85.5 Rb 37	87.6 Sr 38	88.9 Y 39	91.2 Zr 40	92.9 Nb 41	95.9 Mo 42	98.9 Tc 43	101 Ru 44	103 Rh 45	106 Pd 46	108 Ag 47	112 Cd 48	115 In 49	119 Sn 50	122 Sb 51	128 Te 52	127 I 53	131 Xe 54
133 Cs 55	137 Ba 56	139 La 57	178 Hf 72	181 Ta 73	184 W 74	186 Re 75	190 Os 76	192 Ir 77	195 Pt 78	197 Au 79	201 Hg 80	204 TI 81	207 Pb 82	209 Bi 83	209 Po 84	210 At 85	222 Rn 86
223 Fr 87	226 Ra 88	227 Ac 89															

139 La 57	140 Ce 58	141 Pr 59	144 Nd 60	147 Pm 61	150 Sm 62	152 Eu 63	157 Gd 64	159 Tb 65	162 Dy 66	165 Ho 67	167 Er 68	169 Tm 69	173 Yb 70	175 Lu 71
227 Ac 89	232 Th 90	231 Pa 91	238 U 92	237 Np 93	244 Pu 94	243 Am 95	247 Cm 96	247 Bk 97	251 Cf 98	254 Es 99	257 Fm 100	256 Md 101	254 No 102	260 Lw 103

$^{1}_{1.0}H$ —indicates Atomic number.
—indicates relative Atomic mass.