



MACHAKOS UNIVERSITY

University Examinations 2019/2020 Academic year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCES

FIRST YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (PUBLIC HEALTH)

HSU101: APPLIED CHEMISTRY

DATE: 4/12/2019

TIME: 8.30-10.30 AM

INSTRUCTIONS TO CANDIDATES

- The paper consists of **two** sections.
- Section **A** is **compulsory**.
- Answer any **two** questions from section **B**.

ADDITIONAL DATA:

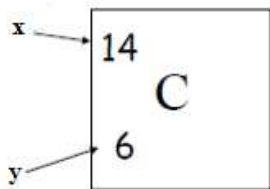
Planck's constant, $(h) = 6.6262 \times 10^{-34} \text{ Js}$

Speed of light, $(c) = 2.998 \times 10^8 \text{ ms}^{-1}$

Periodic table

QUESTION ONE (30 MARKS)

- a) Define an isotope (2 marks)
- b) The figure below is a general representation of elements in the periodic table. Identify the information represented by the letters x and y. (2 marks)



x = _____

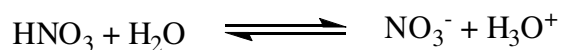
y = _____

- c) There are 3 isotopes of magnesium that occur in nature. Their abundances and masses are listed below:

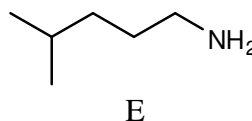
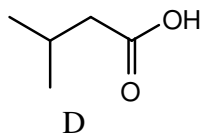
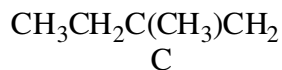
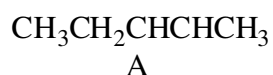
Isotope	% Abundance	Mass (amu)
^{24}Mg	78.99%	23.98504
^{24}Mg	10.00%	24.98584
^{24}Mg	11.01%	25.98259

Calculate the atomic weight of magnesium (3 marks)

- d) A 0.3367 g sample of primary standard grade Na_2CO_3 required 28.66 mL of H_2SO_4 solution to reach the end point in a reaction. Calculate the molarity of the sulphuric acid. (rmm $\text{Na}_2\text{CO}_3 = 106.0$ g) (3 marks)
- e) i Define Spectroscopy (1 mark)
- ii A photon of electromagnetic radiation has a wavelength of 5.87×10^{-7} m. Express this energy in kJ. (4 marks)
- iii Describe how spectra is produced during absorption or emission of a photon of electromagnetic radiation by atoms. (6 marks)
- f) i Define a conjugate base (1 mark)
- ii In the reaction below, identify the conjugate base and the acid (1 mark)



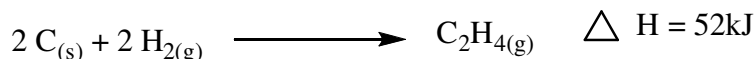
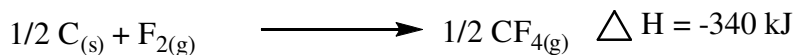
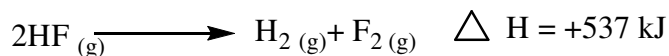
- g) i Identify the homologous series into which the following organic molecules A, B, C, D and E belong. (2 marks)



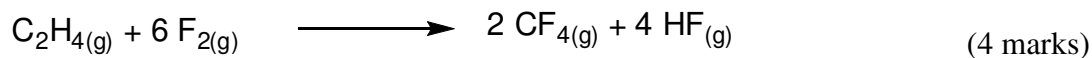
- ii Give the IUPAC name of each of the molecules in g (i) above. (5 marks)

QUESTION TWO (20 MARKS)

- a) Define electronegativity as used in reference to atoms of elements in the periodic table (1 mark)
- b) Discuss the trend in the atomic radius of elements across period 3 of the periodic table. (3 marks)
- c) Given that:



Find ΔH_r° for;

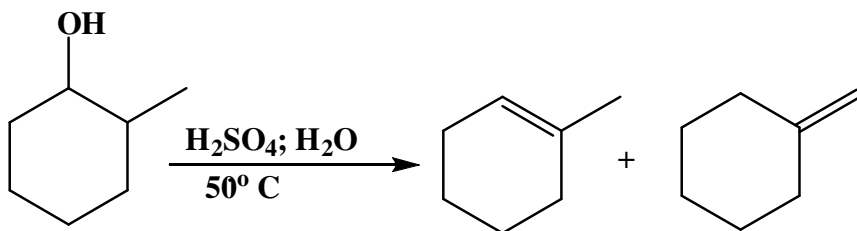


- d) i Describe how atoms attains the octet rule (2 marks)
- ii Using dot (o) and cross (x) to represent electrons, show how carbon tetrafluoride is formed. (4 marks)
- e) State six postulates of the valence shell electron pair repulsion theory (6 marks)

QUESTION THREE (20 MARKS)

- a) Name four way of synthesizing of alkenes (4 marks)
- b) Using an elaborate equation, describe the mechanism for the dehydration of propanol by sulphuric acid in the synthesis of propene. (6 marks)

- c) Show the mechanism of the reaction leading to the product(s) below:



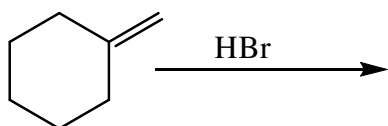
(10 marks)

QUESTION FOUR (20 MARKS)

- a) Differentiate between nuclear fission and nuclear fusion (2 marks)
- b) Describe nuclear transmutation and give an example (3 marks)
- c) Explain the different types of radioactive decay (10 marks)
- d) State five applications of radioactive isotopes (5 marks)

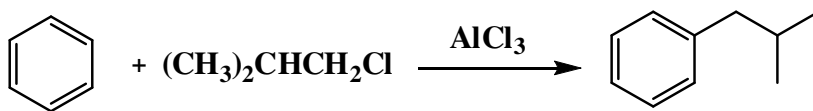
QUESTION FIVE (20 MARKS)

- a)
 - i Describe an electrovalent bond (2 marks)
 - ii Use the VSEPR theory to predict the structure of ammonia molecule (NH_3) (2 marks)
- b) With examples, define weak and strong acid (4 marks)
- c) Predict the products of the reaction below



(4 marks)

- d) Using curly arrows, show the mechanism of the reaction below (8 marks)



Periodic Table of the Elements

1 1A 1A	2 1A 2A	3 1A 3A	4 1A 4A	5 1A 5A	6 1A 6A	7 1A 7A	8 1A 8A	9 1A 9A	10 1A 10A	11 1A 11A	12 1A 12A	13 1A 13A	14 1A 14A	15 1A 15A	16 1A 16A	17 1A 17A	18 1A 18A
1 H 1.008	2 He 4.003	3 Li 6.941	4 Be 9.012	5 B 10.811	6 C 12.011	7 N 14.007	8 O 15.999	9 F 18.998	10 Ne 20.180	11 Na 22.990	12 Mg 24.305	13 Al 26.982	14 Si 28.086	15 P 30.974	16 S 32.065	17 Cl 35.453	18 Ar 39.948
19 K 39.098	20 Ca 40.078	21 Sc 44.956	22 Ti 47.867	23 V 50.942	24 Cr 51.996	25 Mn 54.938	26 Fe 55.845	27 Co 58.933	28 Ni 58.693	29 Cu 63.546	30 Zn 65.38	31 Ga 69.723	32 Ge 72.631	33 As 74.922	34 Se 78.971	35 Br 79.904	36 Kr 83.799
37 Rb 85.468	38 Sr 87.62	39 Y 88.906	40 Zr 91.224	41 Nb 92.906	42 Mo 95.94	43 Tc 98.906	44 Ru 101.07	45 Rh 102.905	46 Pd 106.42	47 Ag 107.868	48 Cd 112.414	49 In 114.818	50 Sn 118.710	51 Sb 121.757	52 Te 127.6	53 I 126.905	54 Xe 131.29
55 Cs 132.905	56 Ba 137.327	57-71 Lanthanide Series	72 Hf 178.49	73 Ta 180.948	74 W 183.84	75 Re 186.207	76 Os 190.23	77 Ir 192.222	78 Pt 195.084	79 Au 196.967	80 Hg 200.592	81 Tl 204.383	82 Pb 207.2	83 Bi 208.980	84 Po 209	85 At 210	86 Rn 222
87 Fr 223	88 Ra 226	89-103 Actinide Series	104 Rf 261	105 Db 262	106 Sg 266	107 Bh 264	108 Hs 277	109 Mt 268	110 Ds 271	111 Rg 272	112 Cn 285	113 Nh 284	114 Fl 289	115 Mc 288	116 Lv 293	117 Ts 294	118 Og 294
57 La 138.905	58 Ce 140.116	59 Pr 140.908	60 Nd 144.24	61 Pm 144.913	62 Sm 150.36	63 Eu 151.964	64 Gd 157.25	65 Tb 158.925	66 Dy 162.50	67 Ho 164.930	68 Er 167.259	69 Tm 168.934	70 Yb 173.054	71 Lu 174.967	72 Hf 178.49	73 Ta 180.948	74 W 183.84
89 Ac 227	90 Th 232	91 Pa 231	92 U 238	93 Np 237	94 Pu 244	95 Am 243	96 Cm 247	97 Bk 247	98 Cf 251	99 Es 252	100 Fm 257	101 Md 258	102 No 259	103 Lr 262	104 Hf 178.49	105 Ta 180.948	106 W 183.84