



MACHAKOS UNIVERSITY

University Examinations 2017/2018

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCES

THIRD YEAR SECOND SEMESTER EXAMINATION FOR
DIPLOMA IN AGRICULTURAL EDUCATION AND EXTENSION

KCM 0102: BASIC ORGANIC CHEMISTRY

DATE 14/12/2017

TIME: 2.00-4.00 PM

INSTRUCTIONS:

- The paper consists of **two** sections.
- Section **A** is **compulsory** (30 marks).
- Answer any **two** questions from section **B** (each 20 marks).

SECTION A (COMPULSORY)

QUESTION ONE (30 MARKS)

(a) Briefly, explain the following terms

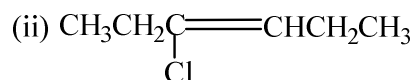
- (i) End point (1 mark)
- (ii) Equivalence point (1 mark)
- (iii) Functional group (1 mark)

(b) Briefly explain the difference between

- (i) Qualitative and quantitative analysis (2 marks)
- (ii) Polar and non-polar molecules (2 marks)

(c) Describe two methods that can be applied to synthesis carboxylic acids. (2 marks)

(d) Draw and label the E and Z isomers for each of the following:



(4 marks)

(e) Precipitation titration is mainly used to determine the amount of chloride in a sample. Discuss the 2 types of precipitation titrations that can be applied to achieve this goal using silver nitrate as the titrant. (4 marks)

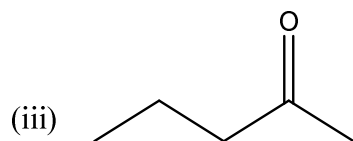
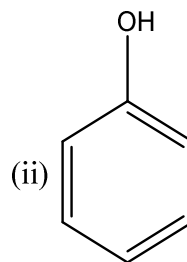
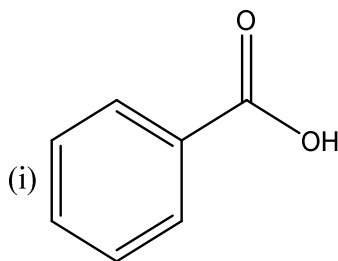
(f) Determine the normality of the following solutions?

i) 0.1381 M NaOH

ii) 0.0521 M H_3PO_4

(iii) 0.5781 g acid (eq wt = 187.3) in 250.0 mL of solution (3 marks)

(g) Identify the functional groups in the following compounds.



(4 marks)

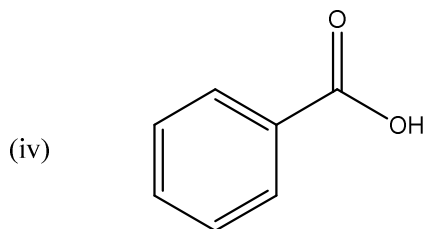
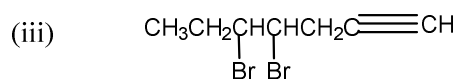
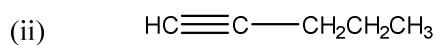
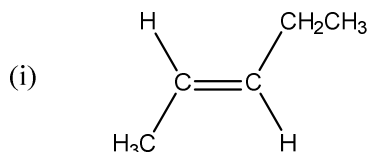
(h) Discuss 2 ways which can be applied to prepare a colloidal system. (4 marks)

- (i) Using water as an example, illustrate how hydrogen bonds are formed. (2 marks)

SECTION B: ATTEMPT ANY TWO QUESTIONS

QUESTION TWO (20 MARKS)

- (a) Provide the correct IUPAC names for the following compounds. Be careful to indicate the geometry where appropriate.



(10 marks)

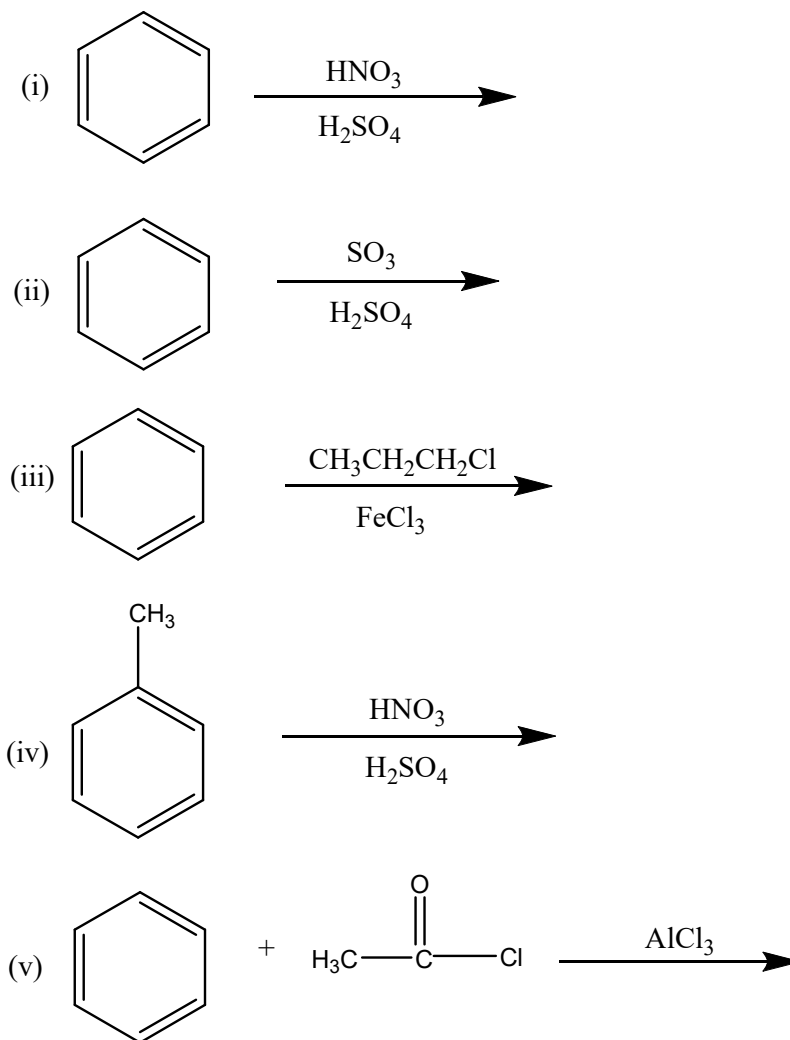
- (b) Describe two ways in which the concentration of a standard solution can be determined. (4 marks)
- (c) Determine the pH of a solution whose $(\text{H}_3\text{O}^+) = 6.2 \times 10^{-9} \text{ M}$? (2 marks)
- (d) The protein content of a sample was determined by a Kjeldahl analysis for nitrogen. After digesting a 0.9814 g sample, the nitrogen content is oxidized to NH_4^+ , converted to NH_3 with NaOH, and the NH_3 distilled into a collection flask contain 50.00 mL of 0.1047 M HCl. The excess HCl is back titrated with 0.1183 M NaOH, requiring 22.84 mL. Determine the % protein in the sample, given that there is 6.38 g of protein for every gram of nitrogen in the sample. (4 marks)

QUESTION THREE (20 MARKS)

- a) In the titration of 25 mL of 0.05 M of AgNO_3 solution with 0.02 M KSCN solution, calculate the molar concentration of Ag^+ in the conical flask solution after the following additions of titrant KSCN solution given that $K_{sp}(\text{AgSCN}) = 1.0 \times 10^{-12}$
- (i) 30 mL
 - (ii) at equivalent point
 - (iii) 100 mL? (9 marks)
- b) Discuss 3 requirements of a primary standard. (6 marks)
- c) A student was given NaOH, a secondary standard, to prepare a standard solution. Explain why NaOH is referred to as a secondary standard and the procedure that the student is supposed to follow in order to determine the exact concentration of the standard concentration. (3 marks)
- d) Find the normality of H_2SO_4 having 49g of H_2SO_4 present in 500 mL of solution. (2 marks)

QUESTION FOUR (20 MARKS)

- (a) Alkalinity is a very important water quality parameter. Define alkalinity and identify the species responsible for alkalinity of water. (4 marks)
- b) Provide the structures of the major product(s) formed in the following benzene reactions. In each case, identify the species responsible.



(10 marks)

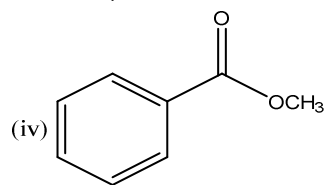
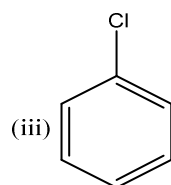
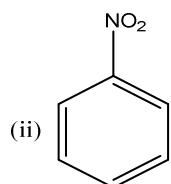
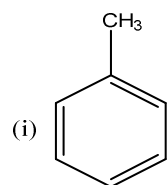
c) Draw a condensed formula for each of the following compounds:

- (i) 2-Methyl-2-hexene
- (ii) *trans*-3-Heptene
- (iii) *cis*-1-Chloro-2-pentene
- (iv) *cis*-2-Chloro-2-methyl-3-heptene

(6 marks)

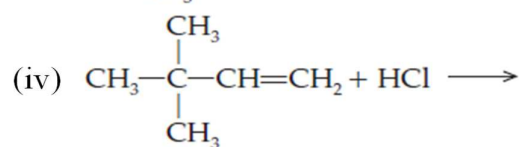
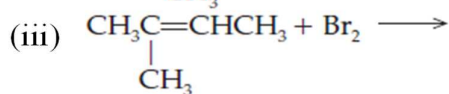
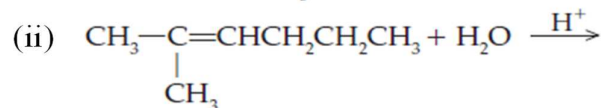
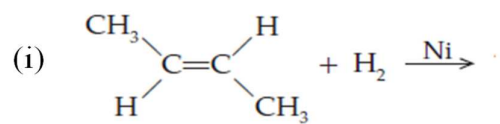
QUESTION FIVE (20 MARKS)

- a) Classify the following groups attached to benzene ring as either para, meta, or ortho directing in benzene reactions. Explain your answer in each case.



(8 marks)

- b) Predict the major product in each of the following reactions and provide the IUPAC name of the product.



(8 marks)

- c) It is without doubt that chemistry has contributed positively to modern agriculture. Using examples, discuss 2 ways in which this has been achieved. (4 marks)

1																							18																														
1	H	1.0079											2	He	4.0026																																						
3	Li	6.941	4	Be	9.0122											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	3											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	65.409	31	Ga	69.723	32	Ge	72.64	33	As	74.922	34	Se	78.96	35	Br	79.904	36	Kr	83.798
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)	44	Ru	101.07	45	Rh	102.91	46	Pd	106.42	47	Ag	107.87	48	Cd	112.41	49	In	114.82	50	Sn	118.71	51	Sb	121.76	52	Te	127.60	53	I	126.90	54	Xe	131.29
55	Cs	132.91	56	Ba	137.33	57-71	*	72	Hf	178.49	73	Ta	180.95	74	W	183.84	75	Re	186.21	76	Os	190.23	77	Ir	192.22	78	Pt	195.08	79	Au	196.97	80	Hg	200.59	81	Tl	204.38	82	Pb	207.2	83	Bi	208.98	84	Po	(209)	85	At	(210)	86	Rn	(222)	
87	Fr	(223)	88	Ra	(226)	89-103	#	104	Rf	(261)	105	Db	(262)	106	Sg	(266)	107	Bh	(264)	108	Hs	(270)	109	Mt	(268)	110	Ds	(281)	111	Rg	(272)	112	Uub	(285)	113	Uut	(284)	114	Uuq	(289)	115	Uup	(288)	116	Uuh	(291)					118	Uuo	(294)
													* Lanthanide series																																								
57	La	138.91	58	Ce	140.12	59	Pr	140.91	60	Nd	144.24	61	Pm	(145)	62	Sm	150.36	63	Eu	151.96	64	Gd	157.25	65	Tb	158.93	66	Dy	162.50	67	Ho	164.93	68	Er	167.26	69	Tm	168.93	70	Yb	173.04	71	Lu	174.97									
													# Actinide series																																								
89	Ac	(227)	90	Th	232.04	91	Pa	231.04	92	U	238.03	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)									