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University Examinations 2012/2013

FIRST YEAR, SECOND SEMESTER EXAMINATIONS FOR CERTIFICATE IN AGRICULTURE AND FIRST YEAR, FIRST SEMESTER EXAMINATION FOR DIPLOMA IN AGRICULTURAL EDUCATION AND EXTENSION

CHE 0100: CHEMISTRY

DATE: AUGUST 2013

c

TIME: 1½ HOURS

INSTRUCTIONS: Answer questions *one* and any other *two* questions.

- Speed of light $c = 2.99792 \times 10^8 \text{ms}^{-1}$
- Plancks constant, $h = 6.6262 \times 10^{-34} \text{Js}^{-1}$

QUESTION ONE (30 MARKS)

- State three basic assumptions made by Dalton on atomic theory. (3 Marks)
- Define a base according to Arrhenius. (2 Marks)
- Using the *s, p d* notations write the electronic configuration for the following elements (4 Marks)
 - Sodium (atomic number 11)
 - Phosphorous (atomic number 15)
 - Aluminium (atomic number 13)
 - Manganese (atomic number 25)
 - Zinc (atomic number 30)
- The wavelength of a certain radiation was $\lambda = 3.4 \times 10^{-5} \text{m}$. Calculate the energy for the radiation in joules. (4 Marks)
- Distinguish between electro negativity and electron affinity. (2 Marks)
- Ionization energy increases from Na, Mg, to Al. Explain (2 Marks)
- Explain the meaning of the term “common ion effect”. (2 Marks)
- Calculate the pH of 0.03M nitric acid. (3 Marks)

- i) Write the structural formula for the following organic compounds. (3 Marks)
- 2-chloro, 2,3-dimethylbutane
 - 2,3-dimethylpent-2-ol
 - 3-methylhexanoic acid
- j) Outline the failures of Neils Behr atomic model. (3 Marks)
- k) What is a redox reaction? (2 Marks)

QUESTION TWO (15 MARKS)

- a) The solubility of silver bromide in water is $7.0 \times 10^{-7} \text{ mole dm}^{-3}$ at 25°C . Calculate its solubility product. (4 Marks)
- b) i) What are isomers? (2 Marks)
- ii) Draw and name the positional isomers in 2-methylhex-1-ene. (3 Marks)
- c) Define the term ionization energy. (2 Marks)
- d) What is the pH of 0.01 mol/dm^3 of benzoic acid ($\text{C}_6\text{H}_5\text{COOH}$), given that $K_a(\text{C}_6\text{H}_5\text{COOH}) = 6.4 \times 10^{-5} \text{ mol/dm}^3$. (4 Marks)

QUESTION THREE (15 MARKS)

- a) Define the term buffer solution. (2 Marks)
- b) Chloric (I) acid (hypochlorous acid is a weak acid $K_a(\text{HClO}) = 3.2 \times 10^{-8} \text{ mol/dm}^3$).
- Calculate $[\text{H}^+]$ and $[\text{OH}^-]$ in $1.25 \times 10^{-2} \text{ M HClO}$. (3 Marks)
 - What is the pH of $1.25 \times 10^{-2} \text{ M HClO}$? (2 Marks)
- c) State the properties of the four quantum numbers. (8 Marks)

QUESTION FOUR (15 MARKS)

- a) Name the following organic compounds. (5 Marks)
- $\text{CH}_3\text{CH}_2\text{NH}_2$
 - $\text{HO}-\text{CH}_2\text{CH}_2\text{CH}_2-\text{OH}$
 - $\text{CH}_3\text{CH}=\overset{\text{H}}{\text{C}}=\text{CH}_2$
 - $\begin{array}{c} \text{CH}_3\text{CHCH}_3 \\ | \\ \text{NH}_2 \end{array}$
 - $\text{HO}-\text{CH}_2\text{CH}_2\text{CH}_2-\text{OH}$
- b) Draw a clearly labeled diagram for the atomic spectra of hydrogen as observed in the Balmer series. (4 Marks)
- c) Distinguish between mole and molarity. (2 Marks)

- d) A 1.0g sample of limestone was allowed to react with 100cm³ of 0.2MHCl acid. The excess acid required 24.8cm³ of 0.1M NaOH solution. Calculate the percentage by mass of calcium carbonate in limestone. (4 Marks)

QUESTION FIVE (15 MARKS)

- a) What is meant by the term functional group in organic chemistry? (2 marks)
 b) Complete the table below by stating the Homologous Series. (7 Marks)

Functional group	Name of Homologous Series
—OH	
—NH ₂	
$\begin{array}{c} \text{O} \\ \parallel \\ \text{—C—OH} \end{array}$	
$\begin{array}{c} & \\ \text{C} & = & \text{C} \\ & \end{array}$	
—C≡C—	
$\begin{array}{c} \text{O} \\ \parallel \\ \text{—C—H} \end{array}$	
$\begin{array}{c} \text{R} \\ \\ \text{C} = \text{O} \\ \\ \text{R} \end{array}$	

- c) State giving a reason the oxidized species in the following chemical reactions. (6 Marks)

