



MACHAKOS UNIVERSITY

University Examinations 2017/2018
SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCES

SUPPLEMENTARY EXAMINATION FOR
DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING
DIPLOMA IN MECHANICAL ENGINEERING
DIPLOMA IN CIVIL ENGINEERING
SCU 102: CHEMISTRY

DATE:

TIME:

INSTRUCTIONS

Answer questions one and any other two.

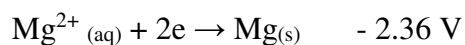
USE: Atomic numbers for: H=1, N=7, O=8, C=6, Al=13, Cl=17, Na=11

SECTION A

QUESTION ONE (30MARKS)

- a) Calculate the pH of 0.2 M H_2SO_4 acid. (3 marks)
- b) (i) Give the conjugate acid of H_2O
(ii) Differentiate between a weak acid and a strong acid.
(iii) Using s p d f orbital write down the electronic configuration of Potassium atomic number 19. (5 marks)
- c) (i) Define an acid using Arrhenius theory.
(ii) Write an appropriate equation to show how HSO_4^- can act as Arrhenius acid. (4 marks)

- d) Show how the hybridization of atomic orbital occurs in Methane molecule, CH₄ and name type of hybridization. (5 marks)
- e) Using dots and crosses draw the electronic structures for water H₂O and methyl radical CH₃. (5 marks)
- f) State the group, period and the block to which element Q atomic number 21 belongs. (4 marks)
- g) Calculate the value of a cell from the standard electrode potentials given below.



SECTION B: ANSWER ANY OTHER TWO QUESTIONS

QUESTION TWO (20MARKS)

- a) Explain what is meant by hydrogen bonding and give an example. (3 marks)
- b) Using dots and crosses draw diagrams to show electronic structures of:
- (i) AlCl₃
 - (ii) Na₂O
 - (iii) C₂H₂ (8 marks)
- c) The atomic nuclei of atoms P and Q contain:
- P- 14 neutrons, 12 protons
- Q- 7 neutrons, 7 protons
- (i) Draw the structure of the hydride of P.
 - (ii) Using s p d f orbital write the electronic configuration of P and Q. (9 marks)

QUESTION THREE (20 MARKS)

- a) The dissociation constant for a weak monobasic acid is $3.2 \times 10^{-8} \text{ mol dm}^{-3}$. Calculate the pH of the acid if its concentration is $1.25 \times 10^{-2} \text{ M}$. (4 marks)
- b) (i) Define a base using the Arrhenius and Bronsted-Lowry theories.
(ii) State two advantages under the Arrhenius theory. (4 marks)
- c) Show by writing an appropriate equation how HCO_3^{-1} can act as Bronsted-Lowry acid and Arrhenius acid. (4 marks)
- d) State the basicity of the following acids and calculate their pH.
 $0.2 \text{ M H}_2\text{SO}_4$
 10^{-2} M HCl (8 marks)

QUESTION FOUR (20 MARKS)

- a) Three elements A, B and C have atomic numbers 17, 12 and 16 respectively. Draw using dots and crosses the structures formed between: (i) A and B (ii) A and C. Name the types of bonds formed. (8 marks)
- b) Define dative (coordinate) bond.
Show how the dative bond is formed when Phosphorous trichloride combines with oxygen. Name the molecule formed. (6 marks)
- c) Q is an element with electronic configuration $1s^2 2s^2 2p^4$.
(i) Write down the atomic number of Q.
(ii) State with reasons whether Q is a metal or a non metal.
(iii) Show how Q will combine with four chlorine atoms. (6 marks)

QUESTION FIVE (30 MARKS)

- a) Explain the following terms.
- (i) Anode
 - (ii) Molten electrolyte (6 marks)
- b)
- (i) Draw a diagram for electrochemical cell using magnesium and iron given that the standard reduction potentials for magnesium and iron are -236 V and -0.44 V respectively. (5 marks)
 - (ii) Write ionic equations for the reactions in each half cell (4 marks)
 - (iii) Write down the overall cell equation. (2 marks)
 - (iv) Calculate the emf of the cell (3 marks)