



# UNIVERSITY OF NAIROBI

SPECIAL/SUPPLEMENTARY EXAMINATIONS 2013/2014

FIRST YEAR EXAMINATIONS FOR THE DEGREE OF BACHELOR OF  
SCIENCE IN MECHANICAL ENGINEERING

FME 151: GENERAL AND INORGANIC CHEMISTRY

DATE: AUGUST 11, 2014

TIME: 11.30 A.M. – 1.30 P.M.

INSTRUCTIONS:

Answer ALL Questions (70 marks)

1. (a) State any THREE characteristics of electromagnetic radiation. [6 marks]
  - (b) What are the THREE main postulations of Bohr's atomic model? [6 marks]
  - (c) Valence Bond Theory is based on linear combination of atomic orbitals, state any TWO main features of this theory. [4 marks]
  - (d) Explain the following observations:
    - (i) Ionization energy generally increases across the period. [3 marks]
    - (ii) The melting point CaO (2927°C) is much higher than that of NaCl (801°C) [3marks]
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2. (a) State Le Chatelier's Principle. [3 marks]
  - (b) State and explain any THREE factors that affect chemical equilibrium [12 marks]
  - (c) Given the equation  $H_2 + I_2 \rightleftharpoons 2HI$ , how does the equilibrium respond to the following:
    - (i) Addition of  $H_2$ ? [3 marks]
    - (ii) Removal of  $I_2$ ? [3 marks]

(d) Using the Born-Landé equation, calculate the lattice energy of  $TiO_2$ , which has the rutile structure with a Madelung constant,  $M$  of 2.408. The effective ionic radii of  $Ti^{4+}$  ( $z = 4$ ) and  $O^{2-}$  ( $z = 2$ ) are respectively 60.5 and 136 pm, with a Born exponent,  $n$ , of 8. The Avogadro's number,  $N_A$ , is  $6.022 \times 10^{23} \text{ mol}^{-1}$  the permittivity of vacuum,  $\epsilon_0$  is  $8.854 \times 10^{-12} \text{ F/m}$  and the electronic charge,  $e$ , is  $1.602 \times 10^{-19} \text{ C}$ .

3. (a) Discuss the main features of the troposphere. [6 marks]
- (b) CFCs are infamous because of their effects on stratospheric chemistry, particularly that of ozone ( $O_3$ ). Discuss stratospheric ozone formation and destruction. [15 marks]