

**NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY**  
**DEPARTMENT OF APPLIED CHEMISTRY**  
**SUPPLEMENTARY EXAMINATIONS - AUGUST 2004**  
**GENERAL CHEMISTRY (SBB, ESH, EFW) – SCH 1217**  
**TIME – (3) THREE HOURS**

**INSTRUCTIONS TO CANDIDATES**

Answer **ALL** questions.

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1. Gas evolved during the fermentative growth of a bacterial culture had a volume of  $580\text{cm}^3$  when measured at a temperature of  $17^\circ\text{C}$ . What was the volume of this gas at the growth temperature of  $37^\circ\text{C}$  (Assume Constant Pressure).  
(15 marks)
  2. Calculate the activities of sodium and sulphate ions in an aqueous solution containing  $0,005\text{M}$  Sodium Chloride and  $0,001\text{M}$  potassium sulphate at  $298\text{K}$ .  
(20 marks)
  3. Calculate:
    - (a) the pH of a solution whose hydrogen ion concentration is  $2,3 \cdot 10^{-9}\text{M}$ .
    - (b) the hydrogen ion concentration in a solution of pH 4,31. (20 marks)
  4. An unstable metabolite decomposed very rapidly in aqueous solution at pH7. At all temperatures in  $15$  to  $37^\circ\text{C}$ , the decomposition proceeded with 1<sup>st</sup> order Kinetics and the following values were obtained for 1<sup>st</sup> order rate constant.

| <u>Temperature<math>^\circ\text{C}</math></u> | <u>Rate Constant <math>\text{K/S}^{-1}</math></u> |
|---|---|
| 15  | $2,51 \cdot 10^{-4}$                              |
| 20  | $4,57 \cdot 10^{-4}$                              |
| 25  | $8,22 \cdot 10^{-4}$                              |
| 30  | $1,445 \cdot 10^{-3}$                             |
| 37  | $3,09 \cdot 10^{-3}$                              |

  
(25 marks)
  5. Some devices are said to "waste" energy. Discuss energy waste in terms of the first and second Laws of thermodynamics. Where does wasted energy go?  
(10 marks)
  6. Suppose a molecule is raised to a higher electronic energy level by absorption of a photon. By what processes may this excitation energy be lost?

**END OF QUESTION PAPER!!!**