



## UNIVERSITY EXAMINATIONS

**FIRST SEMESTER 2025/2026 ACADEMIC YEAR**

**FIRST YEAR EXAMINATION FOR THE DEGREES OF  
BACHELOR OF AGRICULTURAL EDUCATION AND  
EXTENSION, ENSCI AND AGECE**

**CHE/CHEM 113: GENERAL INORGANIC AND PHYSICAL  
CHEMISTRY**

***STREAMS: AGED, ENSCI & AGECE***

***TIME: 2 HRS***

***DAY: TUESDAY [8.30 – 10.30 A.M]***

***DATE: 05/02/2026***

**THIS QUESTION PAPER CONSISTS OF FOUR (4) PAGES**

**PLEASE DO NOT OPEN UNTIL THE INVIGILATOR SAYS SO.**

**INSTRUCTIONS**

**Answer all questions (70 Marks)**

**QUESTION ONE (30 MARKS)**

- a) Highlight the relevance of Chemistry in your specialty (1 Mark)
- b) Explain the variation in ionization energy across the period and down the group of the periodic table (2 Marks)
- c) During preparation of a de-worming drug, 2ml of 10% Albafas is mixed with water in a total volume of 300ml what is the final concentration of the administered drug? if the least effective concentration of this drug is 2.5%, was the farmers preparation effective? If not, in what total volume should the farmer have dissolved the 2ml? (4 Marks)
- d) i) What is the difference between a neutron and a proton of an atom? (1 Mark)
- ii) Calculate the percentage abundances of  $^{12}\text{C}$  and  $^{13}\text{C}$  if the relative atomic mass -  $A_r$ , of naturally occurring carbon is 12.01 given the accurate masses of the isotopes as 12.00 and 13.003. (5 Marks)
- iii) Calculate the volume occupied by one mole of  $\text{CO}_2$  at 300K and 1 bar pressure. ( $R = 8.314\text{JK}^{-1}\text{mol}^{-1}$ ). (3 Marks)
- e) Analysis of a compound with  $M_r$  of 135.02g, made up of sulfur and chlorine only showed that it consisted of 52.51% Cl. Workout the empirical and molecular formula ( $A_r \text{ S} = 32.06$ ;  $A_r \text{ Cl} = 35.45$ ). (5 Marks)
- f) Explain what the following terms mean and in each case use a chemical equation to give one example of such a reaction
- i) Double displacement reaction (2 Marks)
- ii) Redox reactions (2 Marks)
- iii) Synthesis reaction (2 Marks)
- g) i) Write the half reactions that occur during electrolysis of Sodium chloride (2 Marks)
- ii) State the importance of electrochemistry (1 Mark)

**QUESTION TWO (20 MARKS)**

- a) Explain why:
- i) Li has a smaller atomic size than K but larger than that of F. (4 Marks)
  - ii) Cl acquires an electron more easily compared to P and I (4 Marks)
- b) Write down the electronic configuration of Si and Ca and state the group and period in which they belong in the periodic table (4 Marks)
- c) Write a balanced reaction equation for a reaction between:
- i) Sodium carbonate and hydrochloric acid (2 Marks)
  - ii) Nitric acid and magnesium (2 Marks)
  - iii) Differentiate between ionic and covalent bonding. Of the products formed in 2ci above identify a product with ionic bond and one with a covalent bond. (3 Marks)
  - iv) Draw a Lewis dot structure illustrating the covalently bonded product formed in 2cii above (1 Mark)

**QUESTION THREE (20 MARKS)**

- a) Define the term pH (1 Mark)
- b) i) Derive the **Henderson-Hasselbalch** equation for a weak acid (4 Marks)
- ii) Calculate the pH of a buffer made of 0.1 M acetic acid and 0.2 M sodium acetate. The  $pK_a$  of acetic acid is 4.76. (3 Marks)
- c) Explain how a pH meter is calibrated (4 Marks)
- d) Explain the working principles of a flame photometer and highlight its application in real life (8 Marks)

|          |          |                 |           |           |           |           |           |           |           |           |            |          |          |          |          |          |          |
|----------|----------|-----------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|----------|----------|----------|----------|----------|----------|
| 1<br>H   |          |                 |           |           |           |           |           |           |           |           |            |          |          |          |          |          | 2<br>He  |
| 3<br>Li  | 4<br>Be  |                 |           |           |           |           |           |           |           |           |            | 5<br>B   | 6<br>C   | 7<br>N   | 8<br>O   | 9<br>F   | 10<br>Ne |
| 11<br>Na | 12<br>Mg |                 |           |           |           |           |           |           |           |           |            | 13<br>Al | 14<br>Si | 15<br>P  | 16<br>S  | 17<br>Cl | 18<br>Ar |
| 19<br>K  | 20<br>Ca | 21<br>Sc        | 22<br>Ti  | 23<br>V   | 24<br>Cr  | 25<br>Mn  | 26<br>Fe  | 27<br>Co  | 28<br>Ni  | 29<br>Cu  | 30<br>Zn   | 31<br>Ga | 32<br>Ge | 33<br>As | 34<br>Se | 35<br>Br | 36<br>Kr |
| 37<br>Rb | 38<br>Sr | 39<br>Y         | 40<br>Zr  | 41<br>Nb  | 42<br>Mo  | 43<br>Tc  | 44<br>Ru  | 45<br>Rh  | 46<br>Pd  | 47<br>Ag  | 48<br>Cd   | 49<br>In | 50<br>Sn | 51<br>Sb | 52<br>Te | 53<br>I  | 54<br>Xe |
| 55<br>Cs | 56<br>Ba | 57–71<br>La–Lu  | 72<br>Hf  | 73<br>Ta  | 74<br>W   | 75<br>Re  | 76<br>Os  | 77<br>Ir  | 78<br>Pt  | 79<br>Au  | 80<br>Hg   | 81<br>Tl | 82<br>Pb | 83<br>Bi | 84<br>Po | 85<br>At | 86<br>Rn |
| 87<br>Fr | 88<br>Ra | 89–103<br>Ac–Lr | 104<br>Rf | 105<br>Db | 106<br>Sg | 107<br>Bh | 108<br>Hs | 109<br>Mt | 110<br>Ds | 111<br>Rg | 112<br>Uub |          |          |          |          |          |          |

f-block elements

|             |          |          |          |          |          |          |          |          |          |          |           |           |           |           |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|
| Lanthanoids | 58<br>Ce | 59<br>Pr | 60<br>Nd | 61<br>Pm | 62<br>Sm | 63<br>Eu | 64<br>Gd | 65<br>Tb | 66<br>Dy | 67<br>Ho | 68<br>Er  | 69<br>Tm  | 70<br>Yb  | 71<br>Lu  |
| Actinoids   | 90<br>Th | 91<br>Pa | 92<br>U  | 93<br>Np | 94<br>Pu | 95<br>Am | 96<br>Cm | 97<br>Bk | 98<br>Cf | 99<br>Es | 100<br>Fm | 101<br>Md | 102<br>No | 103<br>Lr |