

KABARAK



UNIVERSITY

UNIVERSITY EXAMINATIONS

2010/2011 ACADEMIC YEAR

FOR THE DEGREE OF BACHELOR OF EDUCATION SCIENCE

COURSE CODE: CHEM 111

COURSE TITLE: INORGANIC CHEMISTRY

STREAM: SESSION II

DAY: THURSDAY

TIME: 2.00 – 4.00 A.M

DATE: 14/04/2011

INSTRUCTIONS:

Attempt all questions

Constants

$$h=6.626 \times 10^{-34} \text{Js,}$$

$$C=2.999 \times 10^8 \text{m/s,}$$

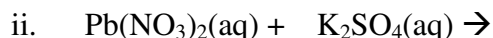
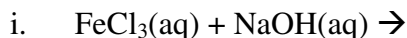
$$N_A = 6.022 \times 10^{23} / \text{mol}$$

PLEASE TURN OVER

QUESTION ONE (17.5marks)

a) Distinguish between a chemical and physical change and give an example in each case. (2marks)

b) Complete and balance the following chemical equations, then write the net ionic equation for each. Include the state (aq, s, l, or g).



c) State and explain the significance of the four quantum numbers, and hence give all the possible quantum numbers that define an electron in the second energy level.

(5.5marks)

d) A certain element consists of two stable isotopes with the masses and percent abundances given below. Determine the molar mass AND identify this element

	Mass of an atom	% abundance
	1.663×10^{-23}	19.9
	1.828×10^{-23}	80.1

(4marks)

QUESTION TWO (17.5marks)

a) Cacodyl, which has an intolerable garlicky odor and is used in the manufacture of cacodylic acid, a cotton herbicide, has a molar mass of 209.96 g/mol. Its mass composition is 22.88% C, 5.76% H, and 71.36% As. What is the molecular formula of cacodyl?

(4marks)

b) Which is the limiting reactant when 100 g of CaC_2 reacts with 100 g of H_2O according to the following reaction?

Equation	$\text{CaC}_2(\text{s})$	+	$2\text{H}_2\text{O}(\text{l})$	\rightarrow	$\text{Ca}(\text{OH})_2(\text{aq})$	+	$\text{C}_2\text{H}_2(\text{g})$
molar masses, in g/mol:	64.10		18.02				

(3marks)

- c) A flask contains a solution with unknown amount of HCl. This solution is titrated with 0.101M NaOH. It takes 3.35ml NaOH to complete the reaction with this HCl. What is the mass of the HCl acid? (3marks)
- d) One method used commercially to peel potatoes is to soak them in a solution of NaOH for a short time, remove them from the NaOH, and spray off the peel. The concentration of NaOH is normally in the range 3 to 6 M. The NaOH is analyzed periodically. In one such analysis, 45.7 mL of 0.500 M H₂SO₄ is required to react completely with a 20.0 mL sample of the NaOH solution. What is the molar concentration of the NaOH solution? (3marks)
- e) Monosodium glutamate (MSG) has the following mass percentage composition: 35.51% C, 4.77 % H, 37.85% O, 8.29% N, and 13.60% Na. What is its molecular formula if its molar mass is 169 gmol⁻¹? (4.5marks)

QUESTION THREE (17.5marks)

- a) Define the following terms.
- i. Electronegativity (2marks)
 - ii. Electron Affinity (2marks)
- b) The second ionization energy of Al is higher than the first. Explain this observation. (2marks)
- c) Using the orbital notation write the electronic configuration of the following elements; B, Mg, Ne and P. (4marks)
- d) If the energy difference between the electronic states of hydrogen atom is 214.68 kJ mol⁻¹, what will be the frequency of light emitted when the electron jumps from the higher to the lower energy state? (2marks)
- e) Hydrogen atoms absorb energy so that the electrons are excited to the energy level n=7. These electrons then undergo the following transitions; n=7 to 1, n=7 to 6 and n=7 to 5. which of these transitions has,
- i. The highest energy (1mark)
 - ii. Arrange these transitions in order of increasing wavelengths. (1.5marks)
 - iii. Calculate the ΔE involved in the n=7 to n=5 transition. (3marks)

QUESTION FOUR (17.5marks)

- a) Differentiate between intramolecular and intermolecular bonds. (2marks)
- b) Explain the existence of the following bonds, giving an example in each case. (2marks)
- Hydrogen bond
 - Dipole-dipole bonds
- c) Illustrate the shapes of the following atomic orbitals: *S*, *P_x*, *P_y* and *P_z*. (3.5marks)
- d) Show the resonance structures of obtained when sulfur bonds to three oxygen atoms. (4marks)
- e) Explain the following observations; (2marks)
- $C_{20}H_{40}$ is a solid at $25^{\circ}C$, while C_4H_8 is a gas at $25^{\circ}C$?
 - Hydrogen forms a negative ion when it combines with sodium to form NaH. (2marks)

Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Period 1	¹ <u>H</u>																	² <u>He</u>
2	³ <u>Li</u>	⁴ <u>Be</u>											⁵ <u>B</u>	⁶ <u>C</u>	⁷ <u>N</u>	⁸ <u>O</u>	⁹ <u>F</u>	¹⁰ <u>Ne</u>
3	¹¹ <u>Na</u>	¹² <u>Mg</u>											¹³ <u>Al</u>	¹⁴ <u>Si</u>	¹⁵ <u>P</u>	¹⁶ <u>S</u>	¹⁷ <u>Cl</u>	¹⁸ <u>Ar</u>
4	¹⁹ <u>K</u>	²⁰ <u>Ca</u>	²¹ <u>Sc</u>	²² <u>Ti</u>	²³ <u>V</u>	²⁴ <u>Cr</u>	²⁵ <u>Mn</u>	²⁶ <u>Fe</u>	²⁷ <u>Co</u>	²⁸ <u>Ni</u>	²⁹ <u>Cu</u>	³⁰ <u>Zn</u>	³¹ <u>Ga</u>	³² <u>Ge</u>	³³ <u>As</u>	³⁴ <u>Se</u>	³⁵ <u>Br</u>	³⁶ <u>Kr</u>
5	³⁷ <u>Rb</u>	³⁸ <u>Sr</u>	³⁹ <u>Y</u>	⁴⁰ <u>Zr</u>	⁴¹ <u>Nb</u>	⁴² <u>Mo</u>	⁴³ <u>Tc</u>	⁴⁴ <u>Ru</u>	⁴⁵ <u>Rh</u>	⁴⁶ <u>Pd</u>	⁴⁷ <u>Ag</u>	⁴⁸ <u>Cd</u>	⁴⁹ <u>In</u>	⁵⁰ <u>Sn</u>	⁵¹ <u>Sb</u>	⁵² <u>Te</u>	⁵³ <u>I</u>	⁵⁴ <u>Xe</u>
6	⁵⁵ <u>Cs</u>	⁵⁶ <u>Ba</u>	⁵⁷ <u>La</u>	⁷² <u>Hf</u>	⁷³ <u>Ta</u>	⁷⁴ <u>W</u>	⁷⁵ <u>Re</u>	⁷⁶ <u>Os</u>	⁷⁷ <u>Ir</u>	⁷⁸ <u>Pt</u>	⁷⁹ <u>Au</u>	⁸⁰ <u>Hg</u>	⁸¹ <u>Tl</u>	⁸² <u>Pb</u>	⁸³ <u>Bi</u>	⁸⁴ <u>Po</u>	⁸⁵ <u>At</u>	⁸⁶ <u>Rn</u>
7	⁸⁷ <u>Fr</u>	⁸⁸ <u>Ra</u>	⁸⁹ <u>Ac</u>	¹⁰⁴ <u>Rf</u>	¹⁰⁵ <u>Db</u>	¹⁰⁶ <u>Sg</u>	¹⁰⁷ <u>Bh</u>	¹⁰⁸ <u>Hs</u>	¹⁰⁹ <u>Mt</u>	¹¹⁰ <u>Ds</u>	¹¹¹ <u>Rg</u>	¹¹² <u>Cn</u>	¹¹³ <u>Uut</u>	¹¹⁴ <u>Uuq</u>	¹¹⁵ <u>Uup</u>	¹¹⁶ <u>Uuh</u>	¹¹⁷ <u>Uus</u>	¹¹⁸ <u>Uuo</u>
			⁵⁸ <u>Ce</u>	⁵⁹ <u>Pr</u>	⁶⁰ <u>Nd</u>	⁶¹ <u>Pm</u>	⁶² <u>Sm</u>	⁶³ <u>Eu</u>	⁶⁴ <u>Gd</u>	⁶⁵ <u>Tb</u>	⁶⁶ <u>Dy</u>	⁶⁷ <u>Ho</u>	⁶⁸ <u>Er</u>	⁶⁹ <u>Tm</u>	⁷⁰ <u>Yb</u>	⁷¹ <u>Lu</u>		
			⁹⁰ <u>Th</u>	⁹¹ <u>Pa</u>	⁹² <u>U</u>	⁹³ <u>Np</u>	⁹⁴ <u>Pu</u>	⁹⁵ <u>Am</u>	⁹⁶ <u>Cm</u>	⁹⁷ <u>Bk</u>	⁹⁸ <u>Cf</u>	⁹⁹ <u>Es</u>	¹⁰⁰ <u>Fm</u>	¹⁰¹ <u>Md</u>	¹⁰² <u>No</u>	¹⁰³ <u>Lr</u>		