|  |
| --- |
| **DEPARTMENT OF CHEMISTRY**  **FOURAH BAY COLLEGE – UNIVERSITY OF SIERRA LEONE** CHEM111PRINCIPLES OF PHYSICAL AND INORGANIC CHEMISTRY**Unit 1 – Moles, Formulae and Equations** **CONTINUOUS ASSESSMENT**  **ASSIGNMENT**  This assignment must be submitted no later than 2 pm on the Friday following Lecture 9 (on redox titrations)  Name: ……………………………………………………  Admission No. ………………..  Note:  Unit 1 Continuous Assessment is worth 15% of the total marks for CHEM111  Your score will be divided into three parts:  Lecture and Tutorial Attendance 10%  Assignment 40%  Test 50% |

## Ensure you present your answers to an appropriate number of significant figures

**Use the atomic masses given in your Periodic Table (ie to 1 dp)**

|  |  |  |
| --- | --- | --- |
| **1.** | (a) | M1: relative atomic mass – average mass of all of the atoms of an element AND relative isotopic mass – mass of an atom (not average)  M2 compared to the mass of one atom of carbon-12 (for both definitions) |
|  | (b) | M3: 9Be has 4 protons and 5 neutrons AND 9B has 5 protons and 4 neutrons  M4: The nucleons (or protons and neutrons) in the different atoms have different masses |
|  | (c) | M5 Ram of R = (206 + 207 + 2(208))/4 = 207.3 (working required) so R = Pb  [5] |
| **2.** | (a) | M1: CuCO3 |
|  | (b) | M2: Cu2O |
|  | (c) | M3: Mg(NO3)2 |
|  | (d) | M4: Al(OH)3 |
|  | (e) | M5: K3P  [5] |
| **3.** | (a) | M1: C:H:O = 40/12 : 6.7/1 : 53.3/16 and N:H:O = 35/14:5/1:60/16  M2: C:H:O = 1:2:1 so ef = CH2O  M3: Efm = 30 so n = 90/30 = 3 so mf = C3H6O3 |
|  | (b) | M4: N:H:O = 2:4:3 so ef = N2H4O3  M5: uf = NH4NO3  [5] |
| **4.** | (a) | M1: mr = 34  M2: Cn = 60/34 = 1.8 moldm-3 |
|  | (b) | M3: n = 0.25 x 0.05 = 0.0125  M4: V = n/C = 0.0125/1.8 = 0.0071 dm3 = 7.1 cm3  M5: final answer given to either 2 dp or 3 dp (7.1 or 7.08)  [5] |
| **5.** | (a) | M1: Moles of ZnSO4 = 2.46/161.5 = 00152 = moles of ZnSO4.*x*H2O  M2: mr of ZnSO4.*x*H2O = 4.38/0.0152 = 287.5 OR moles of water = (4.38 – 2.46)/18 = 0.0107  M3: of which 161.5 is ZnSO4 leaving 126 H2O so x = 126/18 = 7 OR x = 0.0107/0.0152 = 7 |
|  | (b) | M4: n(Zn) = 0.083 and n(HCl) = 0.12 so Zn is in excess  M5: moles of H2 = 0.12/2 = 0.06 so volume of H2 = 0.06 x 22.4 = 1.34 dm3  [5] |
| **6.** | (a) | Deduce the molarity of the calcium nitrate solution formed  M1: mr of Ca3(PO4)2 = 310.3 so moles of Ca3(PO4)2 = 7.26/310.3 = 0.0233  M2: moles of Ca(NO3)2 = 0.070  M3: C of Ca(NO3)2 = 0.070/0.038 = 1.85 moldm-3 |
|  | (b) | M4: Relative mass of all products = 688.3 and relative mass of useful products = 492.3  M5: % atom economy = 492.3/688.3 x 100 = 71.5%  [5] |

|  |  |  |
| --- | --- | --- |
| **7.** | (a) | M1: moles HCl = 0.15 x 0.0332 = 0.00498  M2: moles M2CO3 = 0.0498/2 = 0.00249 so moles M2CO3 in 250 cm3 = 0.00249 x 10 = 0.0249  M3: molar mass of M2CO3 = 3.44/0.0299 = 138.2, so ar of M = (138.2 – 60)/2 = 39.1 |
|  | (b) | M4: volumetric flask error = 0.2, pipette error = 0.05, burette error = 0.05 x 2, mass balance error = 0.005 x 2  M5: % error = 0.2/250x100 + 0.05/25x100 + 0.1/33.2x100 + 0.01/3.44x100 = 0.87%  [5] |
| **8.** | (a) | M1: MgCO3 + H2SO4 🡪 MgSO4 + CO2 + H2O |
|  | (b) | M2: moles of MgCO3 = 6.27/84.3 = 0.0744 = max moles of CO2 possible  M3: CO2 produced = 2.9/44 = 0.0659 so % yield = 88.6% |
|  | (c) | M4: T = PV/nR = 100000 x 0.0022 /(8.31 x 0.0659)  M5: = 401 K (= 128 oC)  [5] |
| **9.** | (a) | M1: Na2CO3 + H2SO4 🡪 Na2SO4 + CO2 + H2O |
|  | (b) | M2: H2SO4 + 2NH3 🡪 (NH4)2SO4 |
|  | (c) | M3: Ca(OH)2 + 2HCl 🡪 CaCl2 + 2H2O |
|  | (d) | M4: 6HNO3 + Al2O3 🡪 2Al(NO3)3 + 3H2O |
|  | (e) | M5: CO2 + NaOH 🡪 NaHCO3 OR CO2 + 2NaOH 🡪 Na2CO3 + H2O  [5] |
| **10.** | (a) | M1: moles of H2SO4 = 0.025 x 0.15 = 0.00375 and moles of NaOH = 0.03 x 0.2 = 0.006  M2: moles of H2SO4 used = 0.003 so moles of H2SO4 remaining = 0.00375 – 0.003 = 0.00075  M3: moles of H+ = 0.0015 so [H+] = 0.0015/0.055 = 0.0272 moldm-3 so pH = 1.56 |
|  | (b) | M4: Initial [H+] = 0.316 moldm-3 so moles of H+ = 7.91 x 10-3 final [H+] = 0.200 moldm-3  M5: final volume = 7.91 x 10-3/0.200 = 0.0396 dm3 = 39.6 cm3 so 14.6 cm3 of water needed  [5] |