

BONDO UNIVERSITY COLLEGE
UNIVERSITY EXAMINATION 2012/2013
1ST YEAR 2ND SEMESTER EXAMINATION FOR THE
DEGREE OF BACHELOR OF EDUCATION SCIENCE WITH
IT (REGULAR)

COURSE CODE:

TITLE:

DATE:

TIME:

DURATION: 2HOURS

INSTRUCTIONS

- 1) This paper contains FIVE [5] questions.
- 2) Answer question ONE [1] COMPULSORY and ANY other TWO [2] questions.
- 3) Write ALL answers in the booklet provided.

Section A This section contains ONE COMPULSORY question

QUESTION 1 (Compulsory -30 marks)

- a) Explain each of the following terms (6 marks)
- i. Qualitative data
 - ii. Derived units
 - iii. Solubility product
 - iv. Complex ion
 - v. Stoichiometric calculations
 - vi. Percent yield

- b) Convert 4.353 micrograms to pounds (2 marks)
- c) The earth's oceans are estimated to be 1.5×10^{18} kL. what is the volume in gallons? (1 gal = 3.785 L) (2 marks)
- d) Concentration of a solution is given as 1.3 mmol/mL. What is the concentration in grams per litre? (3 marks)
- e) The mass of a chemical is measured in four replicates as 2.302, 2.294, 2.312, and 2.294 g. Calculate and report the mean so as to communicate limits in which the measurement must lie. (3 marks)
- f) Predict whether precipitation takes place when each of the following pairs of solutions are mixed. Write the ionic equation where applicable:
- Sodium orthophosphate + calcium nitrate
 - Lead(II) acetate + calcium hydroxide
 - Silver(I) nitrate + potassium iodide
- (6 marks)
- g) Solubility of AgCl is 0.0015 g/L. Calculate its solubility product. (RFM of AgCl = 143.3) (5 marks)
- h) What is the molarity of a solution made by dissolving 37.452 g of aluminium sulphate, $\text{Al}_2(\text{SO}_4)_3$, in water and diluting with water to 250.0 mL total? (3 marks)

Section B: This section contains FOUR questions. Answer ONLY TWO questions.**QUESTION TWO (Optional, 20 marks)**

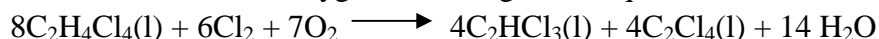
- a) Briefly discuss application of solubility product. (3 marks)
- b) When KCN solution is added to a solution of AgNO₃, a white precipitate is formed which dissolve on further addition of KCN till in excess. Explain. (3 marks)
- c) When excess KCN is added to a solution containing Cu²⁺ and Cd²⁺ ions, Cu(CN)₆⁴⁻ and Cd(CN)₆⁴⁻ ions are formed. When H₂S (g) is passed through the mixture, CdS precipitates from solution despite its higher solubility product. Explain. (3 marks)
- d) The dissociation constant of ammonia is 1.8 x 10⁻⁵. Determine:
- The degree of dissociation of ammonia in a 0.1 M NH₃ solution (2 marks)
 - The concentration of OH⁻ ions in 0.1 M ammonia solution (1 marks)
- e) Given K_{sp}(Mg(OH)₂) is 1.5 x 10⁻¹¹ mol²/L²
- Establish the minimum concentration and pH necessary to prevent precipitation of Mg(OH)₂ from 0.1 M mg²⁺ ions from solution (4 marks)
 - Establish how much NH₄Cl should be added if 0.1 M NH₃ is used. (4 marks)

QUESTION THREE (Optional, 20 marks)

- a) Define the term molarity. (2 marks)
- b) Determine:
- the maximum mass in grams of silver chloride that can be precipitated from solution by mixing 25 mL of 0.05 M MgCl₂ with excess AgNO₃ solution. (4 marks)
 - Moles of silver chloride contained in the mass of the salt formed in (a)i above. (2 marks)
- c) Disulphide dichloride is used in vulcanisation of rubber. Determine
- The mass of S₂Cl₂ that contain 123.8 g of sulphur. (4 marks)
 - The percentage composition of sulphur in S₂Cl₂. (2 marks)
- d) A chemical popularly known as BD or sometimes BDO used to synthesize spandex has controversial uses as well. In 1999, the compound was added to products claimed among other uses to boost immunity, reduce tension and heighten sexual experience. A sample of BD is composed of 53.31% carbon, 11.18% hydrogen and oxygen and has molecular mass of 90.122. Determine its molecular formula.(C = 12.011, H = 1.0074, o = 15.9994) (6 marks)

QUESTION FOUR (Optional, 20 marks)

- a) Tetrachloroethene, C₂Cl₄ often called perchloroethylene (perc) is a colourless liquid used in dry cleaning. It can be formed in several steps from the reaction of dichloroethane, chlorine and oxygen according to the equation:



- i. Write fifteen different conversion factors for relating moles of all the chemicals involved (7 marks)
- ii. Determine
 - I. The mass in pounds of water that form when 362.47 kg of tetrachloroethene, C_2Cl_4 is made. (3 marks)
 - II. the maximum mass of perc, C_2Cl_4 , that can be formed from 23.74 tonnes of dichloroethane, $C_2H_4Cl_2$ (4 marks)
- b) Phosphorus tribromide, PBr_3 , is a useful reagent used to add bromine atoms to alcohol molecules. In an experiment, 5.393 g of 1-bromo-2-methylpropane was obtained when excess PBr_3 was reacted with 6.034 g of 2-methyl-1-propanol according to the equation:

Calculate the percentage yield. (6 marks)

QUESTION FIVE (Optional, 20 marks)

- a) Replicate measurements are given as 2.680, 2.681, 2.680, 2.679 and 2.80 g. If the true value is 2.525 g. Calculate;
 - i. The accuracy (2 marks)
 - ii. Precision (2 marks)
- b) Naturally occurring sample of copper consists of 69.17% copper-63 which has an atomic mass of 62.9296 a.m.u. and 30.83% of copper-65 which has atomic mass of 64.9278 a.m.u. determine the relative atomic mass (R.A.M.) of copper. (3 marks)
- c) Explain why the actual yield in a chemical reaction is usually less than the theoretical yield. (4 marks)
- d) Does the reactant in excess affect the actual yield for a reaction? Explain (2 marks)
- e) About 6.0×10^5 tons of 30% by mass hydrochloric acid, $HCl(aq)$, are used to remove metal oxides from metals to prepare them for painting or for the addition of a chrome covering. How many kilograms of pure HCl would be used to make this hydrochloric acid? (Assume that 30% has two significant figures. There are 1000 kg/ton.) (4 marks)
- f) Name the three isotopes of hydrogen and give their respective symbols (3 marks)

LIST OF CHEMICAL ELEMENTS

Element	Symbol	Atomic no.	Atomic weight	Element	Symbol	Atomic no.	Atomic weight
Actinium	Ac	89	(227)	Mercury	Hg	80	200.59
Aluminium	Al	13	26.981 539	Molybdenum	Mo	42	95.94
Americium	Am	95	(243)	Neodymium	Nd	60	144.24
Antimony	Sb	51	121.75	Neon	Ne	10	20.179 7
Argon	Ar	18	39.948	Neptunium	Np	93	(237)
Arsenic	As	33	74.921 59	Nickel	Ni	28	58.69
Astatine	At	85	(210)	Niobium	Nb	41	92.906 38
Barium	Ba	56	137.327	Nitrogen	N	7	14.006 74
Berkelium	Bk	97	(247)	Nobelium	No	102	(255)
Beryllium	Be	4	9.012 182	Osmium	Os	76	190.2
Bismuth	Bi	83	208.980 37	Oxygen	O	8	15.999 4
Boron	B	5	10.811	Palladium	Pd	46	106.42
Bromine	Br	35	79.904	Phosphorus	P	15	30.973 762
Cadmium	Cd	48	112.411	Platinum	Pt	78	195.08
Caesium	Cs	55	132.905 43	Plutonium	Pu	94	(244)
Calcium	Ca	20	40.078	Polonium	Po	84	(209)
Californium	Cf	98	(251)	Potassium	K	19	39.098 3
Carbon	C	6	12.011	Praseodymium	Pr	59	140.907 65
Cerium	Ce	58	140.115	Promethium	Pm	61	(145)
Chlorine	Cl	17	35.452 7	Protactinium	Pa	91	231.035
Chromium	Cr	24	51.996 1	Radium	Ra	88	226.025 4
Cobalt	Co	27	58.933 20	Radon	Rn	86	(222)
Copper	Cu	29	63.546	Rhenium	Re	75	186.207
Curium	Cm	96	(247)	Rhodium	Rh	45	102.905 50
Dysprosium	Dy	66	162.50	Rubidium	Rb	37	85.467 8
Einsteinium	Es	99	(254)	Ruthenium	Ru	44	101.07
Erbium	Er	68	167.26	Samarium	Sm	62	150.36
Europium	Eu	63	151.965	Scandium	Sc	21	44.955 910
Fermium	Fm	100	(257)	Selenium	Se	34	78.96
Fluorine	F	9	18.998 403 2	Silicon	Si	14	28.085 5
Francium	Fr	87	(223)	Silver	Ag	47	107.868 2
Gadolinium	Gd	64	157.25	Sodium	Na	11	22.989 768
Gallium	Ga	31	69.723	Strontium	Sr	38	87.62
Germanium	Ge	32	72.61	Sulphur	S	16	32.066
Gold	Au	79	196.966 54	Tantalum	Ta	73	180.947 9
Hafnium	Hf	72	178.49	Technetium	Tc	43	(97)
Helium	He	2	4.002 602	Tellurium	Te	52	127.60
Holmium	Ho	67	164.930 32	Terbium	Tb	65	158.925 34
Hydrogen	H	1	1.007 94	Thallium	Tl	81	204.383 3
Iodine	I	53	126.904 47	Thulium	Tm	69	168.934 21
Indium	In	49	114.82	Thorium	Th	90	232.038 1
Iridium	Ir	77	192.22	Tin	Sn	50	118.710
Iron	Fe	26	55.847	Titanium	Ti	22	47.88
Krypton	Kr	36	83.80	Tungsten	W	74	183.85
Lanthanum	La	57	138.905 5	Uranium	U	92	238.028 9
Lawrencium	Lr	103	(260)	Vanadium	V	23	50.941 5
Lead	Pb	82	207.2	Xenon	Xe	54	131.29
Lithium	Li	3	6.941	Ytterbium	Yb	70	173.04
Lutetium	Lu	71	174.967	Yttrium	Y	39	88.905 85
Magnesium	Mg	12	24.305 0	Zinc	Zn	30	65.38
Manganese	Mn	25	54.938 05	Zirconium	Zr	40	91.224
Mendelevium	Md	101	(258)				