



RAJARATA UNIVERSITY OF SRI LANKA  
FACULTY OF APPLIED SCIENCES

B.Sc. Second year Semester I Examination – October/November 2015  
CHE 2105 – Inorganic Chemistry II

Answer both questions.

Time: 1 hour

---

Velocity of light	=	$3 \times 10^8 \text{ m s}^{-1}$
1 amu	=	$1.66 \times 10^{-27} \text{ kg}$
Mass of an electron	=	$9.109 \times 10^{-31} \text{ kg}$
Mass of a proton	=	$1.673 \times 10^{-27} \text{ kg}$
Mass of a neutron	=	$1.675 \times 10^{-27} \text{ kg}$
1 MeV	=	$9.648 \times 10^7 \text{ kJ mol}^{-1}$
Avogadro constant	=	$6.022 \times 10^{23} \text{ mol}^{-1}$

---

The use of non-programmable calculator is permitted.

- 1). (a) Describe one laboratory and one industrial preparation for hydrogen.
- (b) Give the increasing order of melting points of LiF, LiCl, LiBr and LiI. Explain the reasons for your answer.
- (c) Write balanced equation for the following reactions on heating
  - (i)  $\text{NaHCO}_3 \xrightarrow{\Delta}$
  - (ii)  $\text{CaCO}_3 \xrightarrow{\Delta}$
- (d) Give the chemical test that could be used to distinguish between  $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$  and  $[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$ . Find the oxidation state of Co in the coordination compounds.
- (e) Give balanced chemical equations for the reaction of Cu(s) with concentrated and dilute  $\text{HNO}_3$ .
- (f) Write balanced chemical equation when  $\text{H}_2\text{O}_2$  reacts with  $\text{K}_2\text{Cr}_2\text{O}_7$  in acidic medium?

- (g) Write an equation for the following nuclear reaction;  
 (i) beta decay of  $^{14}\text{C}$ ,  
 (ii) the nuclide  $^{232}_{90}\text{Th}$  decays in succession by  $\alpha, \beta, \beta, \alpha, \alpha, \alpha$  and  $\beta$  decay.
- (h) Define radioactivity. State two properties of beta ( $\beta$ ) particles.
- (i) Give two differences between a nuclear reaction and a chemical reaction.
- (j) Explain how the carbon-14 isotope allows certain archaeological discoveries to be dated.

10 x 12 marks = 120 marks)

- 2). Answer either part (A) or part (B)

Part (A)

Answer all parts.

- (a) Write a balanced chemical equation to show the reaction between  $\text{CaH}_2$  and  $\text{H}_2\text{O}$ . How many grams of  $\text{CaH}_2$  are needed to produce 26.4 L of  $\text{H}_2$  gas at  $20^\circ\text{C}$  and  $0.98 \times 10^5 \text{ Pa}$ .  
 (20 marks)
- (b) Account for the following observations:  
 (i) The solubility of  $\text{MgSO}_4(\text{s})$  in water is greater than that of  $\text{BaSO}_4(\text{s})$ .  
 (ii) The hydroxides of alkaline earth metals are less basic than alkali metals of the corresponding periods.  
 (30 marks)
- (c) (i) What products are formed when Li, Na and K burn in dioxygen? How do these products react with water? Write down the balanced relevant chemical equations in each of the reaction.  
 (ii) Explain with equations the production of dihydrogen by coal gasification and water gas shift reaction  
 (30 marks)

Part (B)

Answer all parts.

- (a) Write notes on the following with suitable examples,  
 (i) nuclear fission  
 (ii) nuclear fusion.

(20 marks)

- (b) (i) Outline the principle of rock dating.  
(ii) A certain rock sample contains  ${}_{92}^{238}\text{U}$  and  ${}_{82}^{206}\text{Pb}$  in the mass ratio 5:4.  
Calculate the age of the rock. Half life of  ${}_{92}^{238}\text{U}$  is  $4.8 \times 10^9$  years.  
(20 marks)
- (c) Discuss the application of radioisotopes as tracers in medicine and agriculture.  
(20 marks)
- (d) The following reaction is one of the processes which occur during fission:  
$${}_{92}^{235}\text{U} \rightarrow {}_{58}^{140}\text{Ce} + {}_{40}^{94}\text{Zr} + {}_0^1\text{n} + 6 {}_{-1}^0\text{e}$$
  
Calculate how much energy is released in MeV per fission.  
(20 marks)

Period																	
1	1																2
	H																He
	1.008																4.003
2	3	4											5	6	7	8	10
	Li	Be											B	C	N	O	Ne
	6.941	9.012											10.81	12.01	14.01	16.00	20.18
3	11	12											13	14	15	16	18
	Na	Mg											Al	Si	P	S	Ar
	22.99	24.31											26.98	28.09	30.97	32.06	39.95
4	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	36
	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Kr
	39.10	40.08	44.96	47.88	50.94	52.00	54.94	55.85	58.93	58.69	63.55	65.39	69.72	72.64	74.92	78.96	83.79
5	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	54
	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	Xe
	85.47	87.62	88.91	91.22	92.91	95.94	(98)	101.1	102.9	106.4	107.9	112.4	114.8	118.7	121.8	127.6	131.3
6	55	56		57	58	59	60	61	62	63	64	65	66	67	68	69	70
	Cs	Ba		La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb
	132.9	137.3		138.9	140.1	140.9	144.2	(145)	150.4	152.0	157.2	158.9	162.5	164.9	167.3	168.9	173.0
7	87	88		103	104	105	106	107	108	109	110	111	112	113	114	115	116
	Fr	Ra		Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Uut	Fl	Uup	Lv	Uus
	(223)	(226)		(261)	(262)	(263)	(265)	(266)	(267)	(268)	(269)	(270)	(271)	(272)	(273)	(274)	(275)

Lanthanide Series*	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71
	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
	138.9	140.1	140.9	144.2	(145)	150.4	152.0	157.2	158.9	162.5	164.9	167.3	168.9	173.0	175.0
Actinide Series**	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103
	Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Mn	Lr	
	(227)	(232)	(231)	238	(237)	(244)	(243)	(247)	(250)	(252)	(257)	(258)	(261)	(262)	(263)