KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2017/2018 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER
MAIN EXAMINATIONS

FOR THE DEGREE OF B.ED (SCIENCE)

COURSE CODE: SCH 312

COURSE TITLE: NUCLEAR AND RADIATION CHEMISTRY

DURATION: 2 HOURS

DATE: 09/10/2018 **TIME: 3 – 5PM**

INSTRUCTIONS TO CANDIDATES

- Answer **all** Questions.
- Indicate **answered questions** on the front cover.
- Start every question on a new page and make sure question's number is written on each page.

This paper consists of **3** printed pages. Please Turn Over

KIBU observes ZERO tolerance to examination cheating

Question one

a. Define the following terms (4 marks)

i. Nuclear stability

ii. Radioactivity decay

iii. Mass absorption coefficient

iv. Critical reaction

b. State and explain the four factors that determine nuclear stability (4 marks)

c. From what you understand by the term radioactivity, do you think radioactivity is influenced by temperature and concentration? (4 marks)

d. i differentiate between nuclear fission and fusion giving examples (4 marks)

ii Between heavy elements and lighter elements, which ones are likely to undergo fission and which ones are likely to undergo fusion? Give reasons to your answer (3 marks)

Question two

a. Calculate the binding energy per nucleon of an iron (Fe, Z=26) atom, given that m (^{56}Fe) = 55.934932 and MeV=931 (5 marks)

b. State the characteristics of the binding energy B.E (4 marks)

c. Briefly explain what a radioactive element is (4 marks)

d. Balance the following nuclear equations and identify X (6 marks)

i. $^{212}_{84}Po$---- $^{208}_{82}Pb + X$

ii. $^{137}_{55}Cs$----$X + ^{0}_{-1}e$

iii. $^{26}_{12}Mg + ^{1}_{1}p$----$^{4}_{2}a + X$

iv. $^{235}_{92}U + ^{1}_{0}n$----$^{94}_{36}Kr + ^{139}_{56}Ba + 3X$

v. $^{14}_{7}N + X$----$^{17}_{8}O + ^{1}_{1}p$

e. Nuclear fission using a neutron releases a staggering amount of energy. Complete the following equation below. (3 marks)

$^{235}_{92}U + {}^{1}_{0}n \text{-----} {}^{94}_{38}Sr + X + 3{}^{1}_{0}n + \text{energy}$

Question three

a. State any three application of radioactivity in chemistry (3 marks)

b. What conditions must be satisfied in order that the chemical changes induced by radiation can be used to measure the energy transferred to the absorbing matter in chemical dosimetry (4 marks)

c. calculate the absorption coefficient (u) of H_2O_2 in barns per molecule, given that the atomic absorption coefficient of C, H, and O are 1.266, 0.211 and 1.688b/atom (4 marks)

d. Calculate the mass absorption of CH4 given that the mass absorption coefficient of hydrogen is $0.1266cm^2/g$ and of carbon is $0.6332cm^2/g$ (4 marks)

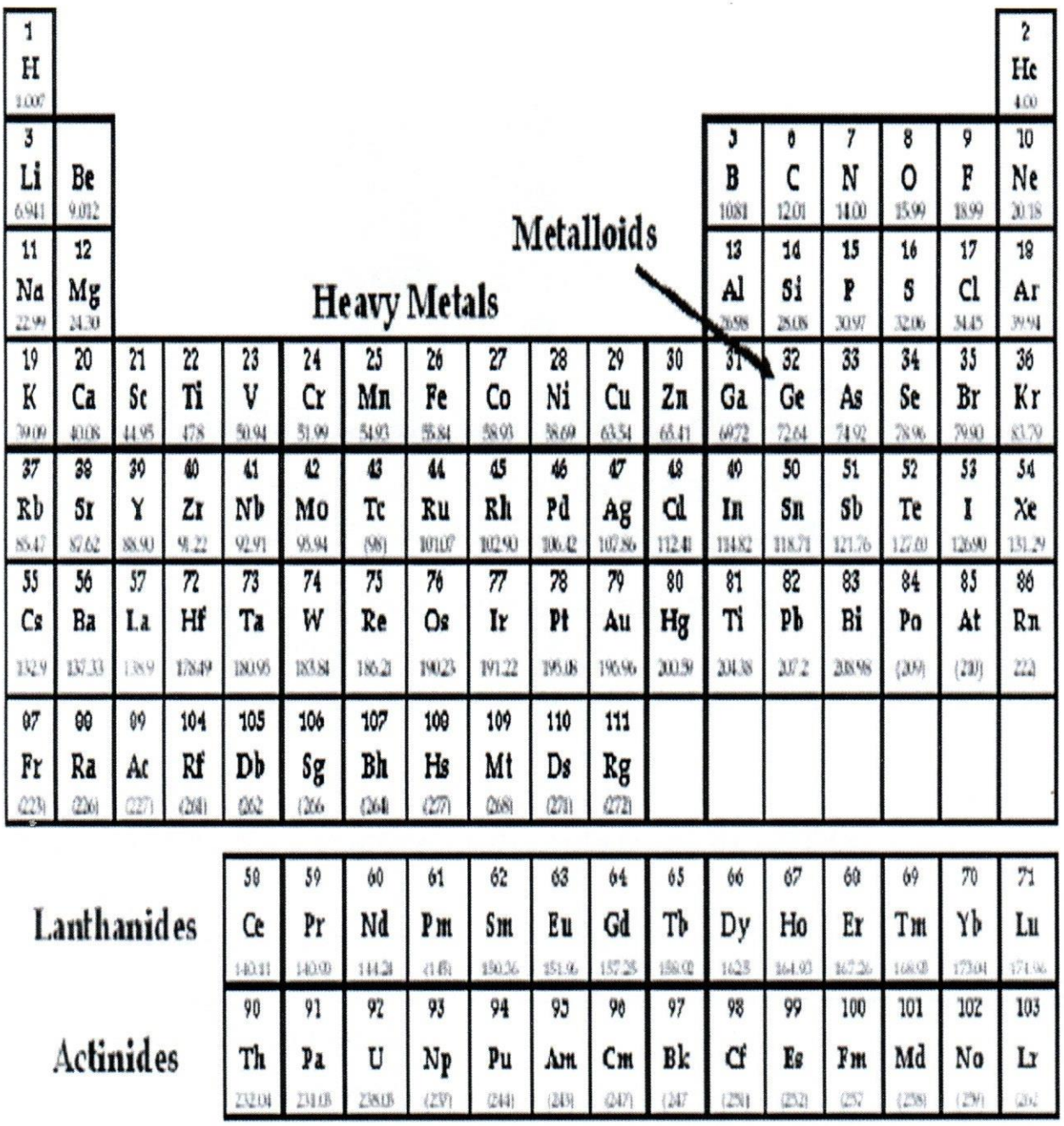
Question four

a. Name four principle modes of interaction of gamma radiation with matter (4 marks)

b. Differentiate between the following mean life and half life (4 marks)

c. Determine the decay constant for carbon 14, if it has a half life of 5730 years (2 marks)

d. if radium -223 has a half life of 10.33 days, what time duration would it require for the activity associated with this sample to decrease 1.5% of its present value? (4 marks)



1 H 1.007																	2 He 4.00
3 Li 6.941	4 Be 9.012											5 B 10.81	6 C 12.01	7 N 14.00	8 O 15.99	9 F 18.99	10 Ne 20.18
11 Na 22.99	12 Mg 24.30											13 Al 26.98	14 Si 28.08	15 P 30.97	16 S 32.06	17 Cl 34.45	18 Ar 39.94
19 K 39.09	20 Ca 40.08	21 Sc 44.95	22 Ti 47.8	23 V 50.94	24 Cr 51.99	25 Mn 54.93	26 Fe 55.84	27 Co 58.93	28 Ni 58.69	29 Cu 63.54	30 Zn 65.41	31 Ga 69.72	32 Ge 72.64	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.79
37 Rb 85.47	38 Sr 87.62	39 Y 88.90	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.90	46 Pd 106.42	47 Ag 107.86	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.76	52 Te 127.60	53 I 126.90	54 Xe 131.29
55 Cs 132.9	56 Ba 137.33	57 La 138.9	72 Hf 178.49	73 Ta 180.95	74 W 183.84	75 Re 186.21	76 Os 190.23	77 Ir 191.22	78 Pt 195.08	79 Au 196.96	80 Hg 200.59	81 Tl 204.38	82 Pb 207.2	83 Bi 208.98	84 Po (209)	85 At (210)	86 Rn 222
87 Fr (223)	88 Ra (226)	89 Ac (227)	104 Rf (261)	105 Db (262)	106 Sg (266)	107 Bh (264)	108 Hs (277)	109 Mt (268)	110 Ds (271)	111 Rg (272)							

Lanthanides	58 Ce 140.11	59 Pr 140.90	60 Nd 144.24	61 Pm (145)	62 Sm 150.36	63 Eu 151.96	64 Gd 157.25	65 Tb 158.92	66 Dy 162.5	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04	71 Lu 174.96
Actinides	90 Th 232.04	91 Pa 231.03	92 U 238.03	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (262)