Total No. of Questions :6]

SEAT No. :

P2613

[Total No. of Pages :3

[5023]-32

M.Sc.

PHYSICAL CHEMISTRY

CH - 311: Nuclear and Radiation Chemistry

(2008 Pattern) (Semester - III)

Time : 3 Hours] *[Max. Marks :80*

Instructions to the candidates:

1) ***Answers to the two sections should be written in separate answer books.***
2) ***All questions are compulsory.***
3) ***Figures to the right side indicate full marks.***
4) ***Use of logarithmic table / calculator is allowed.***
5) ***Neat diagrams must be drawn wherever necessary.***

Physico - Chemical Constants

1.	Avogadro Number	N	=	6.022×10^{23} mol^{-1}
2.	Boltzmann Constant	k	=	1.38×10^{-16} erg K^{-1} molecule^{-1}
			=	1.38×10^{-23} J K^{-1} molecule^{-1}
3.	Planck Constant	h	=	6.626×10^{-27} erg s
			=	6.626×10^{-34} J s
4.	Electronic Charge	e	=	4.803×10^{-10} esu
			=	1.602×10^{-19} C
5.	1 eV		=	23.06 k cal mol^{-1}
			=	1.602×10^{-12} erg
			=	1.602×10^{-19} J
			=	8065.5 cm^{-1}
6.	Gas Constant	R	=	8.314×10^{7} erg K^{-1} mol^{-1}
			=	8.314 J K^{-1} mol^{-1}
			=	1.987 cal K^{-1} mol^{-1}
7.	Faraday Constant	F	=	96487 C equiv^{-1}
8.	Speed of light	c	=	2.997×10^{10} cm s^{-1}
			=	2.997×10^{8} m s^{-1}
9.	1 cal		=	4.184×10^{7} erg
			=	4.184 J
10.	1 amu		=	1.673×10^{-27} kg
11.	Bohr magneton	β_e	=	-9.274×10^{-24} J T^{-1}
12.	Nuclear magneton	β_n	=	5.051×10^{-27} J T^{-1}
13.	Mass of an electron	m_e	=	9.11×10^{-31} kg

P.T.O.

SECTION -I

Q1) Attempt any three of the following: **[15]**

a) Discuss various types of fission.

b) Give classification of Nuclear reactors.

c) Write the salient features of collective model.

d) Discuss the role of moderater and coolant in nuclear reactors.

e) How Rutherford's back scattering technique is used for surface analysis?

Q2) Attempt any three of the following: **[15]**

a) Discuss compound Nucleus theory.

b) Write a note on Vande Graff generater.

c) Discuss the working of cerric sulphate dosimetry

d) Distinguish between somatic and genetic effect of radiation.

e) Write a note on personal dosimetry.

Q3) Solve any two of the following: **[10]**

a) ^{7}Li target is bombarded by protons of energy 5MeV. Calculate

i) the energy of protons scattered through an angle of 90° and

ii) the energy of protons observed at 90° after they have excited the lithium to a level of 0.48 MeV.

b) Compute the energy released in the following fission.

$$^{249}_{99}Es + n \rightarrow {}^{161}_{64}Gd + {}^{87}_{36}Br + 2n.$$

given the following atomic masses.

^{249}Es =249.0762 amu ^{161}Gd =160.928 amu

^{87}Br = 86.922 0 amu n = 1.0087 amu

c) Find out the dose due to 800 μ ci ^{60}Co source at a distance of 5 meters. Given E_γ = 1170 and 1330 keV.

SECTION -II

Q4) Attempt any three of the following: **[15]**

a) Explain the term quenching, scavenger, G-value and spur.

b) Discuss the mechanism of air saturated ferrous sulphate solution. Enlist the factors affecting $G(Fe^{3+})$ in it.

c) Explain the working of Li drifted germanium detecter.

d) Describe the mechanism of radiation annealing.

e) What are various radiolytical products of water? Discuss the free radical theory briefly.

Q5) Attempt any three of the following: **[15]**

a) Discuss the Samuel-Magee model of water radiolysis.

b) Define RBE and rem. Discuss the factors on which relative hazards of a given nuclide depend.

c) Write a note on critical size of nuclear reactor.

d) Discuss the ICRP recommendation for maximum permissible dose

e) Describe estimated short term effects of various single dose whole body radiation exposure in man.

Q6) Solve any two of the following: **[10]**

a) Find out the recoil energy of an atom with man no.80 in K cal/mole for a 5 MeV photon.

b) Find thickness of lead to reduce a dose due to gamma rays from 3.82 rad/min to 0.1 rad/min.

Given $\mu_{pb} = 0.57\ cm^{-1}$

c) Calculate the activity of Na.22 which gives a dose rate of 4 rem/h at a distance of 2 meters. It emits gamma radiations of energy 1.28 MeV.