UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2015/2016

COURSE NAME	:	FUNDAMENTAL OF HEALTH PHYSICS
COURSE CODE	:	DAU 24102
PROGRAMME CODE	:	2 DAU
EXAMINATION DATE	:	JUNE / JULY 2016
DURATION	:	2 HOURS AND 30 MINUTES
INSTRUCTION	:	SECTION A: ANSWER **ALL** QUESTIONS SECTION B: ANSWER **TWO (2)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

SECTION A

Q1 (a) State **TWO (2)** Regulatory Bodies at International and National level which lay down norms for radiation protection.

(2 marks)

(b) List **TWO (2)** dose limits specified by International Commission for Radiation Protection (ICRP) and the National Commission for Radiation Protection (NCRP) for radiation worker.

(2 marks)

(c) The amount of radiation exposure can be minimized by three main method of radiation protection. Discuss **THREE (3)** radiation protection methods which can minimized radiation to the individual.

(12 marks)

(d) In order to optimize radiation protection, the number of people exposed to radiation and the magnitude of their individual doses should obey the ALARA Principle.

i) Define ALARA Principle.

(1 mark)

ii) Discuss the importance and how ALARA Principle is applied to optimize radiation protection.

(8 marks)

Q2 (a) Thermoluminescent dosimetry (TLD) is an example of radiation detectors devices Distinguish **THREE (3)** advantages and disadvantages of using TLD.

(6 marks)

(b) i. Define 'Radiation'.

ii. Discuss (at least **THREE (3)**) the use of radiation detection devices.

(7 marks)

(c) Describe how you would cope with a spillage of liquid radioactive material in the laboratory in order to control the potential hazard and clean up the area.

(12 marks)

SECTION B

Q3 (a) Define radioactivity.

(1 mark)

(b) It was known that isotopes emit penetrating rays either alpha, beta or gamma. Explain THREE **(3)** differentiation between alpha, beta and gamma.

(9 marks)

(c) State **THREE (3)** types of decay process.

(3 marks)

(d) A newly prepared radioisotope has activity 10 mCi. After 4 hours, its activity is reduced to 8 mCi.

i) Calculate the decay constant, λ, and half-life for this radioisotope.

(5 marks)

ii) Calculate number of atoms, N, in Becquerel, Bq, are present when it is newly prepared.

(4 marks)

iii) Calculate the activity after 25 hours.

(3 marks)

Q4 (a) An Aluminum, ${}^{27}_{13}Al$ is bombarded with alpha particles and a Phosphorus, P, is isotope produced.

i) Write the nuclear reaction equation for this reaction.

(2 marks)

ii) Express that both nucleon number and charges are conserved in the reaction.

(4 marks)

iii) The Phosphorus, P, then decays into a stable Silicon (Si) isotope with an emission of a positron. Write the equation representing this reaction.

(2 marks)

(b) An incoming x-ray photon of wavelength 10.0 pm are incident on a target. Calculate the wavelength of the x-ray when it scattered at 60°.

(8 marks)

(c) Several types of interactions with matter have been observed when photon travels and hits either an electron or nucleus. Explain briefly the interaction of the following:

i) Rayleigh scattering.

ii) Photoelectric absorption.

iii) Pair Production.

(9 marks)

Q5 (a) List the **TWO (2)** source of radiation.

(2 marks)

(b) We are exposed to radiation every day and become hazards to our lives. Describe internal hazard and external hazard.

(8 marks)

(c) Explain briefly the effects of radiation in long term effect and short term effect.

(10 marks)

(d) A 70 kg worker is accidentally exposed to gamma radiation and receives an affective dose 5.5 rem. Calculate the absorbed dose received by the worker in Gray (Gy) (Given: weighting factor, W_T : 0.04, Quality factor, Q :1).

(5 marks)

-END OF QUESTIONS –

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LIST OF FORMULA

$D = \frac{A_o}{\sqrt{2}} t_1$	$\frac{dN}{dt} = -\lambda N$
$E = \frac{hc}{\lambda}$	$V = \frac{Q}{C}$
$A = \frac{dN}{dt}$	$ln \frac{N}{N_o} = kt$
$k = \frac{ln2}{T_{1/2}}$	$\frac{l_1}{l_2} = \frac{{d_1}^2}{{d_2}^2}$
$A = A_o e^{-\lambda t}$	$T_{1/2} = \frac{ln2}{\lambda}$
$N = N_o e^{-\lambda t}$	$X = \frac{dQ}{dm}$
$N = \frac{\frac{-dN}{dt}}{\lambda}$	$D = \frac{E}{m}$
$D = D_o e^{-\mu x}$	$D_W = D_G$
$H(Sv) = D(Gy)Weight$ $H_T(Sv) = \sum_R W_R D$ $E(Sv) = \sum_T W_T H$ $H = H_1 + H_2$	$D_W = \frac{N_g E}{m}$

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LIST OF CONSTANT

$$Avogadro's\ Number, N_A = 6.023 \times 10^{23}\ atoms$$
$$Electron\ charge, e = 1.6 \times 10^{19} C$$
$$Electron\ mass, m_e = 9.109 \times 10^{-31} kg$$
$$Neutron\ mass, m_n = 1.675 \times 10^{-27} kg$$
$$Proton\ mass, m_p = 1.673 \times 10^{-27} kg$$
$$Atomic\ mass\ number, u = 1.6605 \times 10^{-27} kg$$
$$= 931.5 MeV$$
$$Plank's\ Constant, h = 6.626 \times 10^{-34} J$$
$$Speed\ of\ light, c = 3 \times 10^{8} ms^{-1}$$
$$1\ Curie\ (Ci) = 3.7 \times 10^{10} Becquerel\ (Bq)$$
$$1\ Rad\ (Rad) = 10^{-2}\ Grays\ (Gy)$$
$$1\ Rem(rem) = 10^{-2} Sieverts\ (Sv)$$
$$1\ Roentgen\ (R) = 2.58 \times 10^{-4}$$
$$\frac{Coulomb}{kilogram} \left(\frac{C}{kg}\right)$$
$$1\ Gy = 100\ rad = 1 Jkg^{-1}$$
$$1\ R = 8.77 \times 10^{3} Grays\ (Gy)$$
$$Absorbed\ Dose, D$$
$$Equivalent\ Dose, H$$
$$Effective\ Dose, E$$
$$Exposure, X$$
$$Radiation, R$$
$$Tissue, T$$
$$Charge, Q$$
$$Number\ of\ ionized, N_g$$
$$Dose\ to\ the\ wall, D_w = dose\ to\ the\ gas, D_G$$