

UNIVERSITY COLLEGE LONDON

University of London

EXAMINATION FOR INTERNAL STUDENTS

For the following qualifications :-

M. Sc.

M.Sc. Radiation Biology: Paper 2

COURSE CODE : **RDBL0002**

DATE : **30-APR-02**

TIME : **10.00**

TIME ALLOWED : **3 hours**

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TURN OVER

Please use a SEPARATE ANSWER BOOK for EACH QUESTION

Standard electronic calculators may be used.

Answer FIVE questions

1. What is a free-air ionization chamber and what is it used for? Describe and discuss its limitations. In practice, e.g. in a radiotherapy department, how can these problems be overcome in dealing with photon radiation energies from 20 keV to 20 MeV.
2. Describe the radioecological processes which may occur after the release of radioactive Cesium in a minor reactor accident to cause radiation exposure of the people living a few kilometers away. Draw a sketch illustrating these processes and discuss the factors which influence the transfer factors.
3. Describe the structural aberrations which are induced by radiation in chromosomes. Describe their dependence on the cell cycle. How do they behave at the subsequent mitosis?
4. Describe the phenomenon of radiation-induced genomic instability and its possible implication in the process of radiation carcinogenesis.
5. It is often claimed that the reason for the increased radioresistance of larger tumours compared to smaller tumours is an increased hypoxic fraction of tumour stem cells in larger tumours. How would you test this hypothesis?
6. Discuss the concept of radiation-mediated gene therapy of cancer and the problems it is still facing.
7. Describe the epidemiological design of the Life Span Study (LSS) of the Japanese A-bomb survivors. How were the radiation doses determined for each study participant in the presently used dosimetric system (DS86)? Discuss the problems of neutron doses in the Hiroshima survivors and their importance for estimating radiation risks at low doses of photons. What are the advantages and disadvantages of the cancer incidence and the cancer mortality data, respectively?

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8. Which radiation damage to intrauterine development has been well documented in humans? Draw the dose response curves for severe mental retardation after irradiation in the different stages of pregnancy. Discuss the evidence for the existence of a dose threshold for radiation damage to the developing embryo.
9. Describe the pathogenesis of oral mucositis which occurs during radiotherapy of head and neck cancers. Which role is played by cytokines in the radiation response of the oral mucosa? Which role is the therapeutic application of cytokines expected to play in future?
10. During your visit in the thermal gallery in Bad Gastein you collected air samples. Describe the methods of taking samples and of how the activity concentration of radon and the equilibrium constant is determined. You measured a radon concentration of approximately 100 kBq/m^3 . What was your exposure in working level months considering that you were in the high radon concentration area for 30 minutes. Take 25 kBq/m^3 as equivalent to 1 WL; on which other factor does this relationship depend. Compare your exposure there with the radiation exposure (in working level months) of a person who lives for ten years in a house with a measured radon concentration just below the action level of 200 Bq/m^3 . Describe the radiobiological basis and its assumptions for converting WLM into lung dose and effective dose.

END OF PAPER