

Reading directions for Syllabus RPE

Students for the training levels RPE and RPO VRS-C follow the lectures together, using the Syllabus available from the Groningen Academy for Radiation Protection (GARP), which is in principle intended for the RPE. However, a number of topics that are dealt with in this syllabus do not belong to the material for the training level RPO VRS-C. The numbers of Chapters and Sections mentioned below refer to the edition of December 2019.

Chapter 1: Mathematics

- not Section 1.6 (*interpolation*)
- not Section 1.7 (*series expansion*)

note: Chapter 1 is in itself not examination material, but knowledge of Chapter 1 is necessary in order to be able to solve problems at the level RPO VRS-C

Chapter 2: Compartment systems

- this Chapter can be skipped in its entirety

Chapter 3: Statistics

- Section 3.4 (*significance of a measurement*): not the text after the first example (about *one-tailed probability*)
- not Section 3.5 (*exactness, accuracy and precision of a measurement*).

Chapter 4: Atomic and nuclear structure

- this Chapter must be studied in its entirety

Chapter 5: Radioactivity

- Section 5.2 (*α -decay*): not the text about *recoil energy*
- Section 5.8 (*mother-daughter relationship*): not the text after Figure 5.10 (the complicated Formulas that describe mother-daughter relations); however, one must be familiar with the concept of *radioactive equilibrium* if $T_{1/2}(\text{mother}) \gg T_{1/2}(\text{daughter})$ and with the fact that in the case of equilibrium mother and daughter activities are virtually equal to each other after several half-lives of the daughter

Chapter 6: Interactions of radiation with matter

- not Section 6.1.1 (*fluence and flux*); however, one must be familiar with the concept of *flux density*

- Section 6.1.3 (*energy loss and linear range of charged particles*): not the text after Formula 6.3; however, one must be familiar with the concepts of *linear range* and *bremstrahlung*
- not Section 6.1.4 (*cross section and attenuation coefficient*); however, one must be familiar with the text after Formula 6.10 (about *linear and mass attenuation coefficients*)
- not Section 6.3 (*protons*)
- Section 6.4 (*β -particles en electrons*): not the text after Formula 6.23
- not Sections 6.4.1 (*Čerenkov radiation*), 6.4.3 (*electromagnetic cascade*) and 6.5.1 (*Rayleigh scattering*)
- Section 6.5.3 (*Compton effect*): not Formula 6.27 and the text after Formula 6.28
- not Sections 6.5.6 (*composite materials*), 6.6.2 (*energy transfer*), and 6.6.3 (*classification of neutrons*)
- not Section 6.6.4 (*neutron activation*); however, one must be familiar with the concepts of *radiative neutron capture* and *thermal neutron*
- Section 6.6.5 (*nuclear fission*): only the first sentence

Chapter 7: Basic dosimetry

- most of this Chapter can be skipped with the exception of Sections 7.1 (*exposure*) and 7.2 (*absorbed dose and kerma*), and the *rules of thumb* $d_\gamma \approx E_\gamma/7$ and $d_\beta \gg d_\gamma$

Chapter 8: Biological effects of radiation

- not Section 8.1.4 (*cell cycle*)
- Section 8.2 (*interaction of ionizing radiation with tissue*): not Table 8.1 and the text thereafter
- not Sections 8.3 (*radiation induced cell death*), 8.5.3 (*gonads and fertility*), and 8.7 (*ICRP-103 versus ICRP-60*)

Chapter 9: Operational dosimetry

- not Section 9.2 (*operational quantities*); it is sufficient to know what *ambient dose equivalent* $H^*(d)$ and *personal dose equivalent* $H_p(d)$ mean, and that $H^*(10)$ and $H_p(10)$ are good estimators of the effective dose E
- not Sections 9.3 (*collective effective dose*) and 9.4 (*ICRP-103 versus ICRP-60*)

Chapter 10: Dosimetry of internal exposure

- Section 10.2.1 (*number of disintegrations*): only the text up to and including the first example
- Section 10.3 (*gastrointestinal model*): only the text up to and including Table 10.6
- Section 10.4 (*lung model*): only the text up to and including the first Paragraph after Figure 10.7; however, Sections 10.4.1 (*gasses and vapors*), 10.4.2. (*aerosols*), and 10.4.3 (*lung purification*) must be studied
- Section 10.5 (*bone model*): only the text up to Table 10.11

- not Sections 10.6 (*submersion model*), 10.7 (*measuring internal contamination*), and 10.8 (*ICRP-100 versus ICRP-30*)

note: it is not necessary to be able to calculate the value of and to calculate with the quantities U_s , $SAF(T \leftarrow S)$ and $SEE(T \leftarrow S)$; however, one must understand the models for gastrointestinal tract and lungs, and one must be able to work with the dose conversion coefficient $e(50)$

Chapter 11: Detection of radiation

- not Sections 11.1.2.2 (*digital imaging*) and 11.1.2.3 (*other semiconductor devices*)
- Section 11.2.3 (*thermoluminescence*): only the first Paragraph
- not Sections 11.4.3 (*time domain analysis*), 11.6.1 (*ambient dose equivalent*), 11.6.2 (*neutron dose*), 11.6.3 (*personal dose*), 11.9.3 (*optimal division of the available measuring time*), and 11.9.4 (*minimum detectable activity*)

Chapter 12: Shielding of external radiation

- not Section 12.7 (*skyshine*)

Chapter 13: Recommendations of the ICRP

- it is recommended to read Section 13.1 (*historical overview*)
- Sections 13.2.2 (*definitions*) and 13.2.3 (*protection framework during operations*) must be studied in its entirety
- Section 13.3.1 (*occupational exposure*): one must know the *risk factor* = 5% per Sv
- the rest of this Chapter can be skipped

Chapter 14: Laws and regulations

- not Section 14.4.8 (*security of radioactive materials*)
- not Section 14.7 (*specific regulations for devices*)
- global knowledge of Section 14.9.3 (*consequences of ionizing radiation for the environment*) suffices; however, one must be familiar with the concept of $MID = 0,25$ ID in Section 14.9.3.4 (*further analysis*)
- global knowledge of Section 14.9.4 (*risk management guide for practises with open sources in laboratories*) suffices
- not Section 14.10 (*other specific regulations*)

Chapter 15: Devices

- this chapter can be skipped in its entirety

Chapter 16: Sealed sources

- this chapter must be studied in its entirety

Chapter 17: Open sources

- this chapter must be studied in its entirety

Chapter 18: Fissile materials

- this chapter can be skipped in its entirety

Chapter 19: Background radiation

- most of this Chapter can be skipped with the exception of Section 19.6 (*average radiation load of the general population*)

Chapter 20: Medical supervision of exposed workers

- this chapter can be skipped in its entirety

Chapter 21: Non-ionizing radiation

- this chapter can be skipped in its entirety