1. What type of dose-response relationship is characterized by an early response to a high-dose exposure?

2. What type of dose-response relationship is characterized by a late response to low-dose exposure(s)?

3. What is described as a measure of the rate at which energy is transferred from ionizing radiation to soft tissue?
1. Deterministic (nonstochastic)
2. Stochastic (probabilistic)
3. LET (linear energy transfer)
1. What are two examples of radiation-induced conditions that follow a linear non-threshold dose-response relationship?

2. Skin effects that result from fluoroscopic exposure follow what type of dose-response relationship?

3. What type of effects are described as: “those biologic somatic effects of ionizing radiation that exhibit a threshold dose below which the effect does not normally occur and above which the severity of the biologic damage increases”? 
1. Genetic effects, radiation-induced cancer, leukemia
2. Nonlinear (sigmoid), threshold dose response
3. Nonstochastic (deterministic) effects
1. What is the cellular component having the greatest radiobiological significance?

2. What effect does the presence of oxygen have on radiosensitivity?

3. Which of the following ionizing radiations has the highest LET?
   alpha, beta, gamma
1. DNA
2. Oxygen increases radiosensitivity.
3. Alpha
1. What is the term used to describe the human sequence of events following high-level radiation exposure, and leading to death in a short time?

2. List the three major types of acute radiation syndrome.

3. Which of the three types of acute radiation syndrome requires the least amount of ionizing radiation dose to occur?

4. Fill in the $W_r$:

<table>
<thead>
<tr>
<th></th>
<th>$W_r$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gamma</td>
<td></td>
</tr>
<tr>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Alpha</td>
<td></td>
</tr>
</tbody>
</table>
1. Acute radiation syndrome
2. Hematological, gastrointestinal, and CNS (central nervous system)
3. Hematological
4. 

<table>
<thead>
<tr>
<th></th>
<th>$W_r$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gamma</td>
<td>1</td>
</tr>
<tr>
<td>$x$</td>
<td>1</td>
</tr>
<tr>
<td>Alpha</td>
<td>20</td>
</tr>
</tbody>
</table>
1. Describe the energy and LET of occupational radiation.

2. Give two examples of common *local* tissues that can be affected by ionizing radiation.

3. *Erythema* can be an effect of excessive ionizing radiation exposure to what body part?

4. List the following in order of decreasing radiosensitivity:
   - skin, lungs, gonads, liver
1. Low energy and low LET
2. Skin, lens of eye, chromosomes
3. Skin
4. Gonads, lungs, liver, skin
1. Radiation-induced biologic damage to living organisms is termed _______ effects.
2. Nonstochastic effects may also be referred to as _______ effects.
3. Fill in the NCRP-recommended dose limits:

<table>
<thead>
<tr>
<th>Tissue/Exposure</th>
<th>Dose Limit (mSv)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lens of eye (annual)</td>
<td>______ mSv</td>
</tr>
<tr>
<td>Embryo/fetus (1 month)</td>
<td>______ mSv</td>
</tr>
<tr>
<td>Thyroid (annual)</td>
<td>______ mSv</td>
</tr>
<tr>
<td>Skin, hands, and feet (annual)</td>
<td>______ mSv</td>
</tr>
<tr>
<td>Gonads (annual)</td>
<td>______ mSv</td>
</tr>
</tbody>
</table>
### Section I: Radiation Protection

#### 1: Biological Aspects of Radiation

1. somatic
2. deterministic

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Lens of eye (annual)</td>
<td>150 mSv</td>
</tr>
<tr>
<td>Embryo/fetus (1 month)</td>
<td>0.5 mSv</td>
</tr>
<tr>
<td>Thyroid (annual)</td>
<td>500 mSv</td>
</tr>
<tr>
<td>Skin, hands, and feet (annual)</td>
<td>500 mSv</td>
</tr>
<tr>
<td>Gonads (annual)</td>
<td>50 mSv</td>
</tr>
</tbody>
</table>
1. Somatic effects that occur within minutes, hours, days, or weeks after initial irradiation are termed_________.
2. What minimum radiation dose is required in order for acute radiation syndrome (ARS) to occur?
3. The latent period (in ARS) decreases as radiation exposure _________.

Section I: Radiation Protection
1. early, or short-term, effects
2. 100 rad (1 Gy)
3. increases
1. How does oxygenation affect cell/tissue radiosensitivity?
2. What is the LD 50/30 for adult humans?
1. The presence of oxygen increases cell/tissue radiosensitivity.
2. 300 to 400 rad (3-4 Gy)
1. A dose of 200 rad (2 Gy) to the skin can cause a radiation-induced reddening, termed __________.
2. Ionizing radiation-induced hair loss is termed ____________.
3. What is the name of the particularly radiosensitive male sex cell?
Section I: Radiation Protection

1: Biological Aspects of Radiation

1. erythema
2. epilation or alopecia
3. Spermatogonia
1. What is the target organ believed responsible for radiation-induced leukemia?
2. What radiation exposure dose to the ovaries will result in temporary infertility?
3. In which portion of pregnancy is the embryo/fetus most radiosensitive?
1. Bone marrow
2. 200 rad (2 Gy)
3. The first trimester