### P6.2 Summary questions

1. **This type of exposure is...**  
<table>
<thead>
<tr>
<th></th>
<th>Contamination</th>
<th>Irradiation</th>
</tr>
</thead>
<tbody>
<tr>
<td>being exposed to background radiation</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>taking radioactive material into the body</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>having radioactive material on your skin</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>eating radioactive food</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

2. **In nuclear fusion/less massive/nuclei/combine/to form more massive/nuclei.**  
   a. In nuclear fission/more massive/nuclei/split/to form less massive/nuclei.  
   b. In a chain reaction neutrons from one fission reaction trigger other fission reactions.

3. **When you use gamma radiation to diagnose disease you ask a patient to take in radioactive material that gives out gamma radiation and look at the patient with a gamma camera.**  
   a. When you use gamma radiation to treat cancer you focus gamma rays onto cancerous tissue to kill it.  
   b. The half-life of material used to produce gamma radiation for a tracer is very short (hours), but the half-life of material used to produce gamma radiation for a gamma knife does not need to be so short.  
   c. You need to reduce the exposure of the patient to gamma radiation so most of the radioactive material should have decayed in a day. The gamma camera can be shielded from people using appropriate materials.

4. Scientists have reported that there has been a leak of radioactive material from a hospital.
   The radiation is not very dangerous because it has a half-life of only a few seconds, so will decay very quickly.
   You will be irradiated if you go near the hospital, so you can reduce your risk by keeping clear.

5. **contamination**  
   a. The damage to the human body depends on the type of radiation emitted as well as the half-life. Alpha radiation is more damaging than gamma radiation (so a long lived alpha source in your body is very hazardous).

6. **They involve nuclei, they involve a change in mass producing energy.**  
   a. Fission involves splitting a nucleus and fusion involves joining nuclei together.

7. **239 − 100 − 134 = 5**  
   a. The number tells you the number of protons + neutrons. Charge is conserved, therefore the number of protons is the same, so subtracting tells you the neutrons left over.  
   b. If they were not absorbed you could have an uncontrolled chain reaction, i.e. a bomb.

8. **lead because it absorbs alpha and beta radiation and most of gamma radiation**
b so that they are not contaminated by getting the material on their skin

c In a gamma camera, a patient ingests a radioactive material, so you need a short half-life, i.e. hours.
   In a gamma knife, you need to keep using it for a long time so it needs a long half-life.