1. Complete the entries in the following table.

<table>
<thead>
<tr>
<th>element</th>
<th>symbol</th>
<th>mass number</th>
<th>atomic number</th>
<th>number of electrons</th>
<th>number of neutrons</th>
<th>$^m_zX$</th>
</tr>
</thead>
<tbody>
<tr>
<td>helium</td>
<td>He</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>magnesium</td>
<td>Mg</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>$^{12}_6C$</td>
</tr>
<tr>
<td>fluorine</td>
<td>F</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Calculate the frequency of red light of wavelength $\lambda = 700$ nm. (1 nm = $1 \times 10^{-9}$ m).

3. Microwaves are part of the electromagnetic spectrum and have frequencies between $\nu = 3 \times 10^9$ Hz and $3 \times 10^{12}$ Hz. What are the corresponding wavelengths?

4. Ionising radiation has energy $\geq 1.93 \times 10^{-18}$ J per photon. Using this criterion, determine whether the following are ionising.

   (a) UV light of $\nu = 1.00 \times 10^{16}$ Hz
   (b) IR light of $\nu = 3 \times 10^{13}$ Hz

5. An atom of a given element has 17 protons in its nucleus. Draw an electron orbit diagram which shows the distribution of its electrons between the $n = 1$, $n = 2$ and $n = 3$ electron shells in the ground state.

6. Define each of the following and give an example of each to illustrate your answer.

   (a) allotropes
   (b) isotopes

7. As the atomic number increases, the neutron:proton ratio increases. What does this suggest is a factor in nuclear stability?

8. Three kinds of radiation make up nearly all of the radiation observed from naturally occurring radionuclides. What are they?