

**Work through the ChemCAL module "*Atomic and Nuclear Structure*".****Work through the iChem module "Atomic Symbol"**

1. Complete the entries in the following table.

| element   | symbol | mass number | atomic number | number of electrons | number of neutrons | ${}^m_z\text{X}$    |
|-----------|--------|-------------|---------------|---------------------|--------------------|---------------------|
| helium    |        |             | 2             |                     |                    |                     |
|           | C      |             |               | 6                   |                    | ${}^{12}_6\text{C}$ |
| magnesium |        |             | 12            |                     | 12                 |                     |
| fluorine  |        |             |               | 9                   |                    |                     |

2. Calculate the frequency of red light of wavelength  $\lambda = 700 \text{ nm}$ . ( $1 \text{ nm} = 1 \times 10^{-9} \text{ m}$ ).
3. Microwaves are part of the electromagnetic spectrum and have frequencies between  $\nu = 3 \times 10^9 \text{ Hz}$  and  $3 \times 10^{12} \text{ Hz}$ . What are the corresponding wavelengths?
4. Ionising radiation has energy  $\geq 1.93 \times 10^{-18} \text{ J}$  per photon. Using this criterion, determine whether the following are ionising.
- UV light of  $\nu = 1.00 \times 10^{16} \text{ Hz}$
  - IR light of  $\nu = 3 \times 10^{13} \text{ Hz}$
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.
- allotropes
  - 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?