Answers to Exercise 2.2
Isotopic Mass Calculations

1.

$$M_{Sr} = \left(\frac{0.56\%}{100\%} \times 83.9134u\right) + \left(\frac{9.86\%}{100\%} \times 85.9093u\right) + \left(\frac{7.00\%}{100\%} \times 86.9079u\right) + \left(\frac{82.58\%}{100\%} \times 87.9056u\right)$$

$$M_{Sr} = 0.47u + 8.47u + 6.08u + 72.59u$$

$$M_{Sr} = 87.62u$$

*Your answer should have **2 decimal places** (see second line of calculation; all digits must be retained in the calculator until the final answer is obtained) therefore 4 significant figures.*
This answer matches the mass on the periodic table and is similar to all of the isotopic masses, so it seems reasonable.

2. **Step 1: Look up average atomic mass of rubidium (Rb) on periodic table**

$$M_{Rb} = 85.4678u$$

Step 2: Work out the percent abundance for each isotope

If the percent abundance of ^{85}Rb is 72.165% then the percent abundance of ^{87}Rb must be 100% - 72.165% = 27.835% (since the sum of the percent abundances must be 100%).

Step 3: Calculate the isotopic mass of ^{87}Rb

$$M_{Rb} = \frac{\%_{Rb-85}}{100\%} M_{Rb-85} + \frac{\%_{Rb-87}}{100\%} M_{Rb-87}$$

$$85.4678u = \left(\frac{72.165\%}{100\%} \times 84.9118u\right) + \left(\frac{27.835\%}{100\%} \times M_{Rb-87}\right)$$

$$M_{Rb-87} = \frac{(85.4678u - 61.277u)}{0.27835} = 86.909u$$

Step 4: Check your work

Does your answer seem reasonable? Are sig. fig. correct?
^{87}Rb should have a mass that is approximately 87 u.

3. **Step 1: Look up average atomic mass of iridium (Ir) on periodic table**

$M_{Ir} = 192.22u$

Step 2: Set up equations relating percent abundances to average atomic mass and to each other

$$M_{Ir} = \frac{x}{100\%} M_{Ir-191} + \frac{y}{100\%} M_{Ir-193}$$

There are only two naturally occurring isotopes, so x + y = 100%

Step 3: Solve for one of the two percent abundance values (solving for x is shown)

$$M_{Ir} = \frac{x}{100\%} M_{Ir-191} + \frac{100\% - x}{100\%} M_{Ir-193}$$

$$192.22u = \frac{x}{100\%}(190.9606u) + \frac{100\% - x}{100\%}(192.9629u)$$

$$19222\% = x(190.9609) + 19296.29\% - x(192.9629)$$

$$2.0022x = 74\%$$

$$x = 37\%$$

Therefore, the natural abundance of ^{191}Ir is 37%

Step 4: Solve for the other percent abundance value

The natural abundance of ^{193}Ir is 100% - 37% = 63%

Step 5: Check your work

Does your answer seem reasonable? Are sig. fig. correct?

The average atomic mass of Ir is greater than 192 u (the "halfway point" between 191 and 193), so we expect the natural abundance of ^{193}Ir to be greater than that of ^{191}Ir.