1.  

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<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>liquid mercury</td>
<td>element</td>
<td>ice</td>
<td>molecular compound</td>
</tr>
<tr>
<td>neon gas</td>
<td>element</td>
<td>liquid nitrogen</td>
<td>element</td>
</tr>
<tr>
<td>milk</td>
<td>mixture</td>
<td>copper pipe</td>
<td>element</td>
</tr>
<tr>
<td>blood</td>
<td>mixture</td>
<td>air</td>
<td>mixture</td>
</tr>
<tr>
<td>gaseous CO₂</td>
<td>molecular compound</td>
<td>gaseous oxygen</td>
<td>element</td>
</tr>
<tr>
<td>solid sodium</td>
<td>element</td>
<td>brass</td>
<td>mixture</td>
</tr>
</tbody>
</table>

2. \( {\frac{234}{90}} \text{Th} \): the number of neutrons is \( 234 - 90 = 144 \).

3. \( \text{O}^{2-}, \text{F}^- \) and Ne have exactly 10 electrons.

\[
\begin{align*}
\text{O}^{2-} & \quad \text{Atomic number 8} \rightarrow -2 \text{ anion has 10e}^- \\
\text{He} & \quad \text{Atomic number 2} \rightarrow 2e^- \\
\text{Ar} & \quad \text{Atomic number 18} \rightarrow 18e^- \\
\text{F}^- & \quad \text{Atomic number 9} \rightarrow -1 \text{ anion has 10e}^- \\
\text{Sr} & \quad \text{Atomic number 38} \rightarrow 38e^- \\
\text{S}^{2-} & \quad \text{Atomic number 16} \rightarrow -2 \text{ anion has 18e}^- \\
\text{Cl}^- & \quad \text{Atomic number 17} \rightarrow -1 \text{ anion has 18e}^- \\
\text{O} & \quad \text{Atomic number 8} \rightarrow 8e^- \\
\text{F} & \quad \text{Atomic number 9} \rightarrow 9e^- \\
\text{Ne} & \quad \text{Atomic number 10} \rightarrow 10e^- \\
\end{align*}
\]

4. (c) chromium, manganese, iron, cobalt, nickel

5. (d) fluorine, chlorine, bromine, iodine

6. Molecular mass of CH\(_3\)NH\(_2\):

\[
12.01 (\text{C}) + 3 \times 1.01 (\text{H}) + 14.01 (\text{N}) + 2 \times 1.01 (\text{H}) = 31.06 \text{ g mol}^{-1}
\]

Number of moles in 1 g:

\[
\text{number of moles} = \frac{\text{mass}}{\text{molar mass}} = \frac{1}{31.06} = 0.03 \text{ mol}
\]

Note that the question asks for the number of moles in 1 g. Since this mass is given to only one significant figure, so is the answer.

7. Molar mass of CuSO\(_4\)-5H\(_2\)O:

\[
63.55 (\text{Cu}) + 32.07 (\text{S}) + 4 \times 16.00 (\text{O}) + 5 \times [2 \times 1.01 (\text{H}) + 16.00 (\text{O})]
\]
\[ = 249.72 \text{ g mol}^{-1} \]

Number of moles in 24.9 g of CuSO₄·5H₂O:

\[
\text{number of moles} = \frac{\text{mass}}{\text{molar mass}} = \frac{24.9}{249.72} = 0.100 \text{ mol}.
\]

1 mol of CuSO₄·5H₂O contains 1 mol of copper so,

\[
\text{number of moles of copper} = 0.100 \text{ mol}
\]

Note that the question gave the mass as 24.9 g – three significant figures. The answer reflects this. The trailing zeros in 0.100 imply that the number is known to three significant figures.

8. The relative atomic mass of an element is the weighted average of the masses of its isotopes.

(a) Silicon:

\[
\left( 27.97693 \times \frac{92.21}{100} \right) + \left( 28.97649 \times \frac{4.70}{100} \right) + \left( 29.97376 \times \frac{3.09}{100} \right)
\]

\[
= (25.80) + (1.36) + (0.926) = 28.09 \text{ g mol}^{-1}
\]

The numbers in brackets are given to four, three and three significant figures respectively since this is the precision of the relative abundances in the question. When these are added, the answer is precise to the second decimal place as this is where the point at which each term is known precisely.

(b) Tin:

\[
\left( 111.9048 \times \frac{0.97}{100} \right) + \left( 113.9028 \times \frac{0.65}{100} \right) + \left( 114.9033 \times \frac{0.36}{100} \right) + \left( 115.9017 \times \frac{14.53}{100} \right) + \\
\left( 116.9030 \times \frac{7.68}{100} \right) + \left( 117.9016 \times \frac{24.22}{100} \right) + \left( 118.9033 \times \frac{8.58}{100} \right) + \left( 119.9022 \times \frac{32.59}{100} \right) + \\
\left( 121.9034 \times \frac{4.63}{100} \right) + \left( 123.9053 \times \frac{5.79}{100} \right)
\]

\[
= (1.09) + (0.74) + (0.414) + (16.84) + (8.98) + (28.56) + (10.2) + (39.08) + (5.64) + (7.17) = 118.71 \text{ g mol}^{-1}
\]

The numbers in brackets are given to the same number of significant figures as the precision of the relative abundances in the question. When these are added, the answer is precise to the second decimal place as this is where the point at which each term is known precisely.

9. Let the relative abundances of \(^{35}\text{Cl}\) and \(^{37}\text{Cl}\) be \(a\)% and \(b\)% respectively. Using the approach in Q8:
\[
\left(34.969 \times \frac{a}{100}\right) + \left(36.966 \times \frac{b}{100}\right) = 35.453 \text{ g mol}^{-1}
\]

If these are the only two isotopes then \(a + b = 100\) or \(b = 100 - a\) so,

\[
\left(34.969 \times \frac{a}{100}\right) + \left(36.966 \times \frac{100 - a}{100}\right) = 35.453 \text{ g mol}^{-1}
\]

Solving this gives \(a = 75.764\%\) and \(b = 24.236\%\).

10. Let the relative abundances of \(^{12}\text{C}\) and \(^{13}\text{C}\) be \(a\%\) and \(b\%\) respectively. If these are the only two isotopes then \(a + b = 100\) or \(b = 100 - a\) so,

\[
\left(12.000 \times \frac{a}{100}\right) + \left(13.003 \times \frac{100 - a}{100}\right) = 12.011 \text{ g mol}^{-1}
\]

Solving this gives \(a = 98.903\%\) and \(b = 1.097\%\).