Materials and Their Atoms

1.

   (a) Materials made of individual particles with sizes between 1-1000 nm (or 1-100 nm)

   (b) *(there is no single correct answer for this question, the answer below is just an example)*
        In wearable electronics, because the circuitry can be small but still strong.

2.

   (a) Heterogenous

   (b) Filter the mixture, this will leave the sand behind in the filter paper. Then evaporate the water, this will leave the salt behind in the evaporating dish.

3.

   (a) *(there is no single correct diagram for this question, the diagram below is just an example)*
        All material consists of atoms, which are made of protons and neutrons (in the nucleus) and electrons.
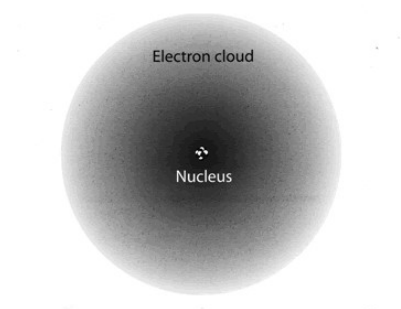
   (b) Electrons are arranged in distinct energy levels.

   (c) A and C

4.

   (a) neutrons = mass number – atomic number = 63 – 29 = 34
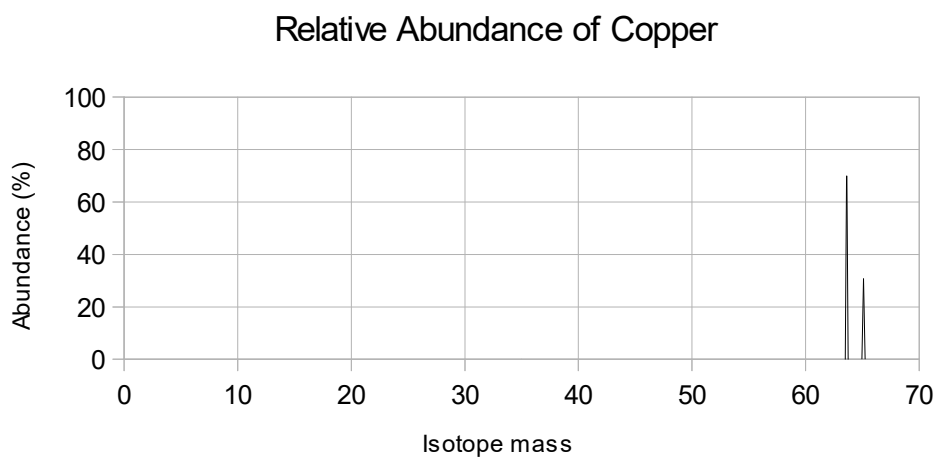
   (b) $^{63}_{29}\text{Cu}$

   (c) The physical properties are different but the chemical properties are the same.

   (d) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^{10}$

   (e) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^9$

   (f) $62.93 \times 0.6917 + 64.93 \times 0.3083 = 63.55$

(g)

Relative Abundance of Copper

5.

(a) 8 × 12.01 + 18 × 1.008 = 114.22 g/mol

(b) $M = 2 \times 16.00 = 32.00$ g/mol

$$n = \frac{m}{M} = \frac{130}{32.00} = 4.06 \text{ mol}$$

(c) For the engine to work well there would need to be a 13th as much fuel as oxygen, so 4.06 ÷ 13 = 0.31 moles.

There is actually $n = \frac{m}{M} = \frac{10}{114.22} = 0.088 \text{ mol}$ which is not close to 0.31, so the engine will not run well.

6.

(a) calcium

(b) fluorine

(c) s