1. How many electrons do the following atom types have?
   A) Carbon
   B) Fluorine
   C) Germanium
   D) Krypton
   E) Br
   F) B
   G) N
   H) O

   A) 6 electrons
   B) 9 electrons
   C) 32 electrons
   D) 36 electrons
   E) 35 electrons
   F) 5 electrons
   G) 7 electrons
   H) 8 electrons

2. What is the mass number of the following:
   A) nickel-60
   B) $^6_{12}$C
   C) hydrogen-3
   D) $^{17}_{37}$Cl

   A) A = 60
   B) A = 12
   C) A = 3
   D) A = 37
3. How many neutrons does each of the atoms in question 2 contain?

   A) \# neutrons = A – Z = 60 – 28 = 32 neutrons
   B) \# neutrons = A – Z = 12 – 6 = 6 neutrons
   C) \# neutrons = A – Z = 3 – 1 = 2 neutrons
   D) \# neutrons = A – Z = 37 – 17 = 20 neutrons

4. Calculate the molecular weight for each of the following:
   A) MgSO₄
   B) H₂O₂
   C) CH₄
   D) H₂SO₄
   E) KMnO₄
   F) K₂Cr₂O₇
   G) NaCl
   H) MgBr₂

   A) \( M = 24.31 + 32.06 + 4 \times 16.00 = 120.37 \text{ gmol}^{-1} \)
   B) \( M = 2 \times 1.008 + 2 \times 16.00 = 34.02 \text{ gmol}^{-1} \)
   C) \( M = 12.01 + 4 \times 1.008 = 16.04 \text{ gmol}^{-1} \)
   D) \( M = 2 \times 1.008 + 32.06 + 4 \times 16.00 = 98.08 \text{ gmol}^{-1} \)
   E) \( M = 39.10 + 54.94 + 4 \times 16.00 = 158.04 \text{ gmol}^{-1} \)
   F) \( M = 39.10 \times 2 + 2 \times 52.00 + 7 \times 16.00 = 294.20 \text{ gmol}^{-1} \)
   G) \( M = 22.99 + 35.45 = 58.44 \text{ gmol}^{-1} \)
   H) \( M = 24.31 + 2 \times 79.90 = 184.11 \text{ gmol}^{-1} \)

5. In 15.2 g of MgSO₄ how many grams of magnesium atoms are there?

   \( n = \frac{m}{M} \)
   \( n = \frac{15.2}{(24.31 + 32.06 + 4 \times 16.00)} = 0.126 \text{ moles of Mg atoms} \)
   \( m = nM = 0.126 \times 24.31 = 3.06 \text{ g of magnesium atoms} \)
6. Calculate the number of moles of hydrogen atoms in 27.5 grams of the following compounds.

A) HClO₄
B) H₃PO₄
C) H₂O
D) C₆H₆O

(A) \( n = \frac{m}{M} \)
\[ = \frac{27.5}{(1.008 + 35.45 + 4 \times 16.00)} = 0.274 \text{ moles of hydrogen atoms} \]

(B) \( n = \frac{m}{M} \)
\[ = \frac{27.5}{(3 \times 1.008 + 30.97 + 4 \times 16.00)} = 0.281 \text{ moles of } H₃PO₄ \]
\[ 0.281 \times 3 = 0.842 \text{ moles of hydrogen atoms} \]

(C) \( n = \frac{m}{M} \)
\[ = \frac{27.5}{(2 \times 1.008 + 16.00)} = 1.53 \text{ moles of } H₂O \]
\[ 1.53 \times 2 = 3.05 \text{ moles of hydrogen atoms} \]

(D) \( n = \frac{m}{M} \)
\[ = \frac{27.5}{(6 \times 12.01 + 6 \times 1.008 + 16.00)} = 0.292 \text{ moles of } C₆H₆O \]
\[ 0.292 \times 6 = 1.75 \text{ moles of hydrogen atoms} \]

7. Write the symbol and name for the elements located in the periodic table as follows:

A) Group IIA and period 4 \textbf{Ca}, \textit{calcium}
B) The third element in period 5 \textbf{Y}, \textit{yttrium}
C) Group VIIB and period 6 \textbf{Hf}, \textit{hafnium}
D) Group VIIIA and period 4 \textbf{Kr}, \textit{krypton}
8. Identify the group and period to which each of the following belong to:
   A) Silicon group IVA, period 3
   B) Carbon-12 group IVA, period 2
   C) Carbon-13 group IVA, period 2
   D) Gallium group IIIA, period 4
   E) Aluminum group IIIA, period 3
   F) He group VIIIA, period 1
   G) O group VIA, period 2

9. Write the electron configuration for:
   a) Rh \(1s^22s^22p^63s^23p^64s^23d^{10}4p^65s^24d^7\)
   b) Ti \(1s^22s^22p^63s^23p^64s^23d^2\)
   c) Ru \(1s^22s^22p^63s^23p^64s^23d^{10}4p^65s^24d^6\)
   d) Rb \(1s^22s^22p^63s^23p^64s^23d^{10}4p^65s^1\)
   e) Sr \(1s^22s^22p^63s^23p^64s^23d^{10}4p^65s^2\)
   f) Pt \(1s^22s^22p^63s^23p^64s^23d^{10}4p^65s^24d^{10}5p^66s^24f^{14}5d^8\)
   g) Cl \(1s^22s^22p^63s^23p^5\)
   h) Au \(1s^22s^22p^63s^23p^64s^23d^{10}4p^65s^24d^{10}5p^66s^24f^{14}5d^9\)
   i) I \(1s^22s^22p^63s^23p^64s^23d^{10}4p^65s^24d^{10}5p^5\)
   j) Si \(1s^22s^22p^63s^23p^2\)

10. Write the abbreviated electron configuration for each of the atoms in question 9.
   (A) \([Kr]5s^24d^7\)
   (B) \([Ar]4s^23d^2\)
   (C) \([Kr]5s^24d^7\)
   (D) \([Kr]5s^1\)
   (E) \([Kr]5s^2\)
   (F) \([Xe]6s^24f^{14}5d^8\)
   (G) \([Ne]3s^23p^5\)
   (H) \([Xe]6s^24f^{14}5d^9\)
   (I) \([Kr]5s^24d^{10}5p^5\)
   (J) \([Ne]3s^23p^2\)
11. Which of the elements in question 9 will have the highest first ionization energy? \( \text{Cl} \)

12. Which of the elements in question 9 will have the smallest atomic radii? \( \text{Cl} \)

13. Which of \( \text{Cl} \) and \( \text{I} \) is most likely to be a solid? \( \text{I} \)

14. Which do you think is a better conductor of electricity \( \text{Ti} \) or \( \text{Zn} \)? \( \text{Ti} \)

15. Looking at group IVA how do the properties of the elements relate to your general knowledge and what you have learnt about the periodic table?

As we descend the group the elements become more metal like. Lead and tin at the bottom of the group are well known metals. Carbon and silicon at the top of the group are brittle and are not ductile or malleable, these are properties of nonmetals.
16.  
A) What is the maximum number of electrons a p subshell can contain?  
B) Which lies higher in energy a 2s subshell or a 3d subshell?  
C) What is the maximum number of electrons a single orbital may contain?  
D) How many orbitals does a d subshell contain?  

(A) 6 electrons  
(B) 3d subshell  
(C) 2 electrons  
(D) 5 orbitals  

17. Determine the following for the fourth shell (n = 4) of an atom:  
(A) The number of subshells.  
(B) The name (or designation) of each subshell.  
(C) The number of orbitals in each subshell.  
(D) The maximum number of electrons that can be contained in each subshell.  
(E) The maximum number of electrons that can be contained in the shell.  

(A) 4 subshells  
(B) 4s 4p 4d 4f  
(C) 4s, 1 orbital; 4p, 3 orbitals; 4d, 5 orbitals; 4f, 7 orbitals  
(D) 4s, 2 electrons; 4p, 6 electrons; 4d, 10 electrons; 4f, 14 electrons  
(E) 2 + 6 + 10 + 14 = 32 electrons
18. Write the electron configurations for the following:
A) An atom that contains 7 electrons.
B) An atom that contains 17 electrons.
C) An atom with Z = 14
D) An atom of Ni

(A) 1s^2\,2s^2\,2p^3
(B) 1s^2\,2s^2\,2p^6\,3s^2\,3p^5
(C) 1s^2\,2s^2\,2p^6\,3s^2\,3p^2
(D) 1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,4s^2\,3d^8

19. Identify the following statements as either true or false:
A) When “building up” an atom electrons are first placed into the orbitals with the highest energy. False
B) The Pauli exclusion principle states that electrons in the same orbital always have different spins. True
C) The Pauli exclusion principle states that electrons in the same subshell always have the same spins. False
D) There are 16 orbitals in an f subshell. False
E) In a p subshell there are three orbitals with the same energy. True
F) In a p subshell there are three orbitals with three different energies. False