1. Exercise General Chemistry   03.11.2023

WS 2023/24

1.1

How many electrons can be in the shell with the main quantum number n = 6? What atomic number would an element have, in which all shells up to and including n = 6 are fully occupied and there are no electrons in higher shells? Give reasons why such an element does not exist.

1.2

Write down the electronic states of the following ions:
Br^-, K^+, S^{2-} und Ga^{3+}

1.3

Complete the following table:

Element	Z	MZ	Np	Nn	Ne
	31	69			31
	53	127			54
Ba^{2+}		138			
			13	14	10
Cl				18	

Z: atomic (ordinal) number, MZ: mass number, Np: number of protons, Nn: n. o. neutrons, Ne: n. o. electrons

1.4

If gold is irradiated with ultraviolet light, electrons emerge from the surface. The energy of the photons is used to release the electrons from the surface. This is possible with light with a wavelength of max. 258 nm. An excess of energy results in electrons with a certain kinetic energy. What is the speed of the emerging electrons when irradiated with 190 nm?

1.5

Calculate the mass percentage of each element in each of the following compounds to four significant figures.
(a) methanol, $CH_3OH(l)$ (b) water, $H_2O(l)$
(c) hydrogen peroxide, $H_2O_2(l)$ (d) Epsom salt, $MgSO_4 \cdot 7H_2O(s)$

1.6

A 3.78-gram sample of iron metal is reacted with sulfur to produce 5.95 grams of iron sulfide. Determine the empirical formula of this compound.

1.7

Sodium hydroxide is extremely soluble in water. A saturated solution contains 572 grams of $NaOH(s)$ per liter of solution. Calculate the molarity of a saturated $NaOH(aq)$ solution.

1.8

How many milliliters of 12.0 M $HCl(aq)$ are required to prepare 250 milliliters of 1.0 M $HCl(aq)$?

1.9

How would you prepare 50.0 milliliters of a 0.200 M $CuSO_4(aq)$ solution, starting with solid $CuSO_4 \cdot 5\ H_2O(s)$?

1.10

A stock solution of hydrazine, $N_2H_4(aq)$, is 95.0% by mass hydrazine and 5.0% by mass water, and its density is 1.011 $g \cdot mL^{-1}$ at 20°C. Calculate the molarity of the solution.