2.1 Atomic & Electronic Structure

Question Paper

Course	DP IB Chemistry
Section	2. Atomic Structure
Topic	2.1 Atomic & Electronic Structure
Difficulty	Easy

Time allowed: 50

Score: /37

Percentage: /100

Question 1a

a)
Deduce the missing information using section 5 of the data booklet, and complete the following table.

Symbol	Protons	Neutrons	Electrons
^{23}Na			
$^{32}S^{2-}$			
$^{86}Sr^{2+}$			

[3 marks]

Question 1b

b)
A sample of Rh contains the following isotopes. Calculate the relative atomic mass of Rh in the sample. Give your answer to 2 dp.

Isotope	% Abundance
^{101}Rh	85
^{102}Rh	15

[2 marks]

Question 1c

c)
Deduce the number of protons, neutrons and electrons in an atom of ^{102}Rh.

[2 marks]

Question 1d

d)
Give the atomic symbol of an element which has more protons than neutrons. Use its most common isotope.

[1 mark]

Question 2a

The atomic mass of each element in the periodic table is based on the carbon-12 scale.

a)
Describe the composition of the nucleus of carbon-12.

[1 mark]

Question 2b

b)
Carbon also exists as the isotope ^{14}C. How does the composition of this isotope differ from that of carbon-12.

[1 mark]

Question 2c

c)
The relative abundance of isotopes in a sample of carbon is 94% ^{12}C and 6% ^{14}C.

How would this information be obtained.

[1 mark]

Question 2d

d)
Calculate the relative atomic mass of the carbon sample in part c)

[1 mark]

Question 3a

a)
Describe what is meant by the term orbital.

[1 mark]

Question 3b

b)
Draw the shapes of the s, p_x, p_y and p_z orbitals.

[2 marks]

Question 3c

c)
State the maximum number of orbitals in the n = 4 energy level.

[1 mark]

Question 3d

d)
List the d, f, p and s orbitals in order of decreasing energies.

[2 marks]

Question 4a

a)
Write the full electronic configurations for the following species

i)
K

ii)
Sr^{2+}

[2 marks]

Question 4b

b)
Write the condensed electronic configurations for the following species

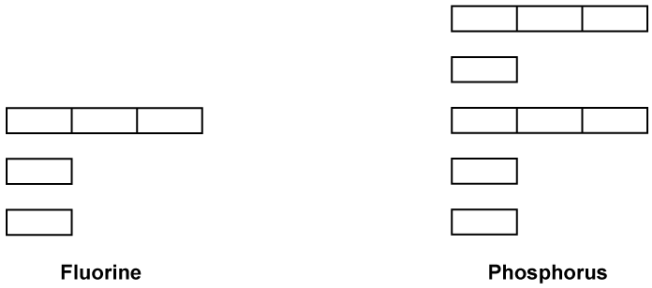
i)
Na

ii)
Al^{3+}

[2 marks]

Question 4c

c)
Complete the orbital diagrams of phosphorus and fluorine as shown in the diagram below.



[2 marks]

Question 4d

d)
Give the number of each type of orbital in the first four energy levels.

[2 marks]

Question 5a

a)
Using sections 1 and 3 of the data booklet describe how the following change in moving from the infrared region of the electromagnetic spectrum to the radio region of the electromagnetic spectrum.

i)
Wavelength

ii)
Frequency

iii)
Energy

[3 marks]

Question 5b

b)
Describe the process occurring in an atom to produce a single line on an emission spectrum.

[3 marks]

Question 5c

c)
Distinguish between a *continuous spectrum* and a *line spectrum*.

[2 marks]

Question 5d

d)
Describe the emission spectrum of hydrogen. Outline how this spectrum is related to the energy levels in the hydrogen atom.

[3 marks]