**Atomic theory Solutions**

**SECTION A: Multiple-choice questions (1 mark each)**

**Question 1**

*Answer:* A

*Explanation:*

Helium is relatively scarce and it can escape the Earth’s atmosphere

**Question 2**

*Answer:* D

*Explanation:*

First ionisation energy increases with the number of outer shell electrons. The units are too large for electronegativity.

**Question 3**

*Answer:* C

*Explanation:*

The outer shell electrons in iodine are further from the nucleus and attracted less. Therefore the electronegativity and the first ionisation energy are both lower.

**Question 4**

*Answer:* C

*Explanation:*

Selenium – count down to the fourth row and third from the right.

**Question 5**

*Answer:* B

*Explanation:*

The number of neutrons will be 40-18 = 22. The number of protons = the number of electrons.

**Question 6**

*Answer:* C

*Explanation:*

An orbital can hold up to 2 electrons. It still exists even if it is empty.

**Question 7**

*Answer:* C

*Explanation:*

With the configuration ending in 3d8, the atom is nickel

**Question 8**

*Answer:* A

*Explanation:*

The electronegativity will decrease as the number of electron shells increases. Option B is incorrect as the elements in the same group have the same number of outer shell electrons.

**Question 9**

*Answer:* D

*Explanation:*

The electron configuration of chlorine is 1s22s22p63s23p5. Number of orbitals = 1+1+3+1+3 = 9

**Question 10**

*Answer:* B

*Explanation:*

The charge on an α-particle is 2+ as it does not have the 2 electrons of a helium atom.

**SECTION B: Short-answer questions**

**Question 1** (6 marks)

**a. i**. That the atom was mostly space if particles are able to move through it unimpeded. 1 mark

 **ii**. Although mostly space, some charged particles existed in the nucleus. 1 mark

**b**. The atom has a small nucleus\* and the positive particles are grouped in that nucleus\*. The

 rebound was occurring when the appositive alpha particles were aimed directly at the

 nucleus. 2 marks

**c**. positive nucleus\* with surrounding electrons\*

 Rutherford was not aware of neutrons 2 marks

**Question 2** (7 marks)

**a**. The periodic table has trends, trends in properties as you move across a period (which this one is

 representing) and trends in properties as you move down a group. 2 marks

**b**. **i**. Electronegativity refers to an atom’s ability to attract electrons. 1 mark

 **ii.** Electronegativity increases as you move across the period\*. This is because the number of electrons in

 the outer shell is increasing and the atom is getting closer to completing its shell.\* 2 marks

 **c**. As you move across a period, the number of protons in the nucleus increases. The attraction to the outer

 shell electrons is increasing, drawing them closer to the nucleus.\* 2 marks

**Question 3** (6 marks)

**a**. The diagram shows the energy level of each subshell of an atom\*. It can be used to determine the order in which electrons occupy subshells\*. 2 marks

**b**. **i**. 1s22s22p63s23p63d14s2 . . 1 mark

  **ii**. calcium 1 mark

 **iii.** p subshell (each member is p1 1 mark

 **iv**. The transition metals are filling d type orbitals. Each subshell has 5 d orbitals or 10 electron

 possibilities. 1 mark

 **Question 4** (5 marks)

**a**. The atom copper has two forms $ $or$ $**.**

 **i**. isotopes 1 mark

 **ii**. Isotopes have different numbers of neutrons but the same number of protons\*. Copper-65 has two

 more neutrons than copper-63.\* 2 marks

 **iii**. Examples include medical isotopes, carbon dating or nuclear power 1 mark

**b**. $$ 1 mark

**Question 5** (10 marks)

**a.** Identify the elements; 3 marks

 **i**. A rubidium

 **ii**. C krypton

  **iii**. D titanium

**b**. **i.** Element C is in Period 4 and Group 18 (VIII). 1 mark

 **ii**. Element G is in Period 3 and Group 2 (II). 1 mark

**c. i.** What section of the Periodic Table is element D in? transition series 1 mark

 **ii**. Which type of subshell is being filled in this section? 3d sub-shell 1 mark

**d. i**. A 1 mark

 **ii**. C 1 mark

 **iii**. G or E 1 mark

**Question 6** (6 marks)

**a**. The Noble gases are virtually unreactive\*.

 They have complete outer shells, therefore no reason to react.\* 2 marks

 **b**. The Noble gases are relatively scarce\* and they are colourless gases\*. 2 marks

 c. Electronegativity is a measure of the ability of an atom to attract electrons. As the outer shell of Noble

 gases is already filled they have virtually no electronegativity. 2 marks