## **Wave Mechanical Model**

1	Which atom in the ground state has an outer- most electron with the most energy? (1) $C_{2}$ (2) Li		6	5 In the ground state, an atom of each of the elements in Group 2 has a different (1) oxidation state		
	(1) Cs	(3) L1		(1) Oxidation state (2) first ionization energy		
	(2) K	(4) Na		(2) mumber of valence electrons		
_				(4) number of electrons in the first shall		
2	In the wave-mechanical model of the atom, an		7	(1) number of electrons in the first shen		
	orbital is the most probable location of			Which term identifies the most probable location		
	(1) a proton	(3) a neutron	-	of an electron in the way	ve-mechanical model of	
	(2) a positron	(4) an electron		the atom?		
				(1) anode	(3) nucleus	
3	What is the total number of valence electrons in a			(2) orbital	(4) cathode	
	germanium atom in the ground state?		0			
	(1) 22	(3) 32	8	Which element has atoms in the ground state with		
	(2) 2	(4) 4		the greatest number of v	alence electrons?	
				(1) tin	(3) arsenic	
4	An orbital is defined as a region of the most probable location of			(2) sulfur	(4) fluorine	
	(1) an electron	(3) a nucleus	9	In the ground state, all a	toms of Group 15	
	(1) an electron	(4) a proton		elements have the same	number of	
	(2) a neutron	(4) a proton		(1) valence electrons	(3) neutrons	
5	According to the wave-mechanical model, an orbital is defined as the			(2) electron shells	(4) protons	
	(1) circular path for electrons		10	In the ground state, valence electrons of a krypton atom are found in		
	(2) circular path for neutrons					
	<ul><li>(3) most probable location of electrons</li><li>(4) most probable location of neutrons</li></ul>			(1) the first shell		
				(2) the outermost shell		
				(3) both the nucleus and the first shell		
				(4) both the first shell and the outermost shell		

Base your answers to questions 11 on the information below and on your knowledge of chemistry.

There are six elements in Group 14 on the Periodic Table. One of these elements has the symbol Uuq, which is a temporary, systematic symbol. This element is now known as flerovium.

11 State the expected number of valence electrons in an atom of the element flerovium in the ground state.

Base your answers to questions 12 on the information below and on your knowledge of chemistry.

Rubidium and iodine have different chemical and physical properties. Some of these properties are shown in the table below.

Some Physical and Chemical Properties of Rubidium and lodine

Rubidium	lodine		
silvery-white solid	bluish-black lustrous solid		
forms ionic compounds with nonmetals	forms ionic bonds with active metals		
reacts with oxygen in the air	sublimes at room temperature		
specific heat = 0.363 J/g(kiid:129)	specific heat = 0.214 J/g(kid:129)		

12 Compare the atomic radius of an atom of iodine to the atomic radius of an atom of rubidium when both atoms are in the ground state.

Base your answers to questions 13 on the information below and on your knowledge of chemistry.

Periodic trends are observed in the properties of the elements in Period 3 on the Periodic Table. These elements vary in physical properties, such as phase, and in chemical properties, such as their ability to lose or gain electrons during a chemical reaction.

13 Identify the element in Period 3 that requires the least amount of energy to remove the most loosely held electrons from a mole of gaseous atoms of the element in the ground state.

Base your answers to questions 14 on the information below and on your knowledge of chemistry.

The Bohr model of the atom was developed in the early part of the twentieth century. A diagram of the Bohr model for one atom, in the ground state, of a specific element is shown below. The nucleus of this atom contains 4 protons and 5 neutrons.



14 State the number of electrons in each shell in this atom in the ground state.

Base your answers to questions 15 on the information below and on your knowledge of chemistry.

The table below shows data for three isotopes of the same element.

lsotopes	Number of Protons	Number of Neutrons	Atomic Mass (u)	Natural Abundance (%)
Atom D	12	12	23.99	78.99
Atom E	12	13	24.99	10.00
Atom G	12	14	25.98	11.01

Data for Three Isotopes of an Element

15 State the number of valence electrons in an atom of isotope D in the ground state.

## **Answer Keys**

- 1 1
- 2 4
- 34
- 4 1
- 53
- 6 2
- 7 2
- . .
- 8 4
- 91

## 10 2

11 Allow 1 credit. Acceptable responses include, but are not limited to:

- 4
- four
- 4e<sup>-</sup>
- four valence electrons
- 12 Allow 1 credit. Acceptable responses include, but are not limited to:
  - In the ground state, the atomic radius of an iodine atom is smaller than the atomic radius of a rubidium atom.
  - The Rb atom is larger than the I atom.
  - The Rb atomic radius is 215 pm, but the I atomic radius is only 136 pm.
- 13 Allow 1 credit for Na or sodium.
- 14 Allow 1 credit. Acceptable responses include, but are not limited to:
  - Number of electrons in first shell: 2 or 2e<sup>-</sup>
  - Number of electrons in second shell: 2 or 2e<sup>-</sup>
- 15 Allow 1 credit for 2 or two.