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CHEMISTRY

Physical Chemistry

Level & Board	OCR (A-LEVEL)
TOPIC:	ATOMIC STRUCTURE
PAPER TYPE:	QUESTION PAPER 2
TOTAL QUESTIONS	12
TOTAL MARKS	43

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Atomic Structure - 2

1. This question pertains to the structure and compounds of Chlorine, Sodium, and Potassium. Most elements are composed of various isotopes.

(a) Provide two examples that highlight the distinctions between two isotopes of a similar element [1]

(b) Please complete the table below for two different elements, one being an ion and the other an atom. [1]

Element	Mass number	Protons	Neutrons	Electrons	Charge
		11	11		-1
	39			19	0

2. This inquiry is about the p-block elements of the periodic table. Oxygen has two isotopes, ^{16}O and ^{18}O , which occur in nature as a mixture.

i. Complete the table to show the atomic structure of ^{18}O . [1]

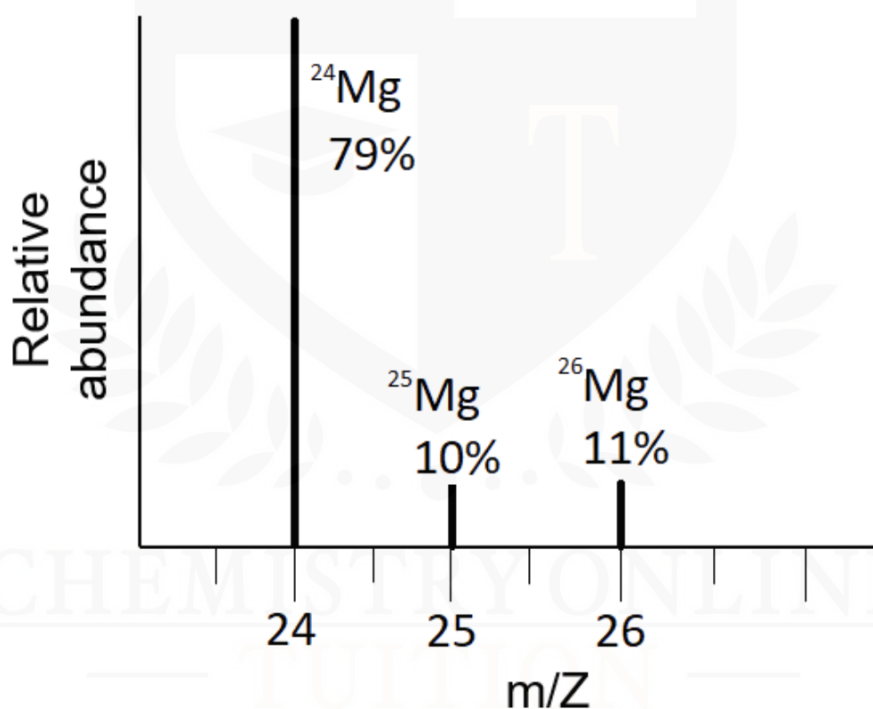
	Protons	Neutrons	Electrons
^{18}O			

ii. A sample of Oxygen is analysed via mass spectrometry, and its mass spectrum displays peaks with relative abundances as follows:

- ^{16}O : 92.76%
- ^{18}O : 7.24%

Calculate the relative atomic mass of Oxygen in the sample.
Round off your answer to two decimal places. [2]

3. This inquiry is about analyzing a sample of Mg using mass spectrometry to produce a mass spectrum of elements from the s-block and p-block of the periodic table.



- i. The mass spectrum peaks are caused by 1+ ions of Mg. Fill in the table below with the number of protons, neutrons, and electrons in each 1+ ion of Ne. [2]

m / z	protons	neutrons	electrons
24			
25			

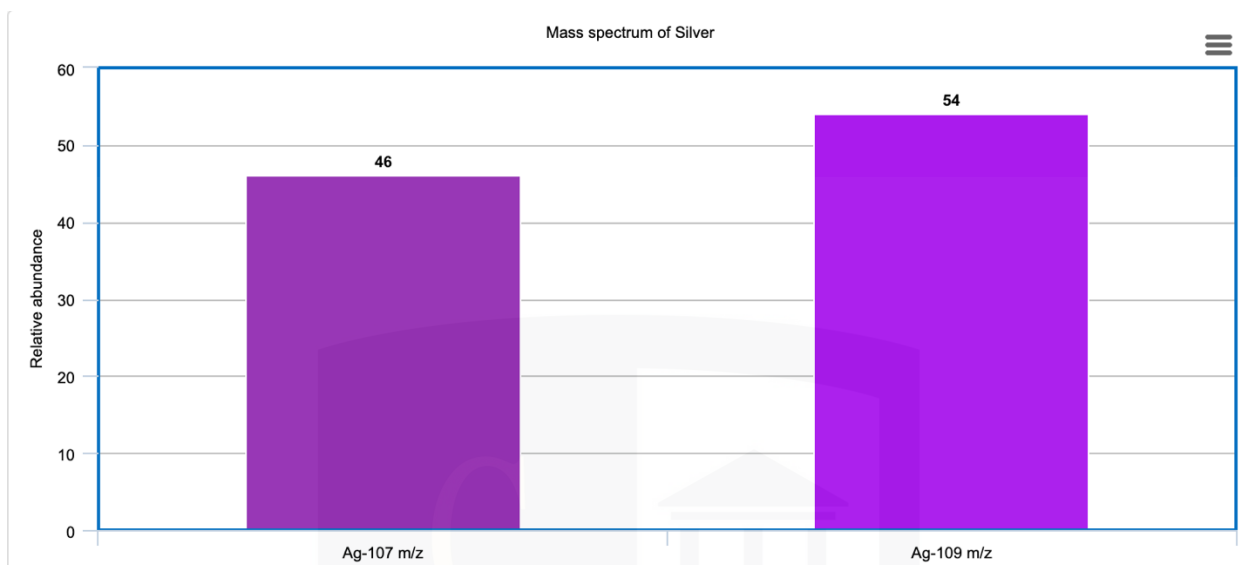
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- ii. Calculate the relative atomic mass of magnesium in the sample. Provide your answer rounded to two decimal places. [2]

4. A coin is made from gold and silver. Gold and silver exist as a mixture of isotopes.

- (a) Give examples of how the atomic structures of various isotopes of the same element differ and are similar. [2]

- (b) The silver is being analysed through the use of mass spectrometry. The resulting mass spectrum can be seen below.



- Find the relative atomic mass of the silver used to make the coins. Give your answer to two decimal places. [2]
- One coin weighing 5.00 g is composed of 84.0% silver by mass. Find the number of silver atoms in one coin. [2]

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5. Argon is a noble gas. Atoms of Argon consist of protons, neutrons, and electrons. Complete the table below. [2]

Particle	Relative mass	Relative charge	Position within the atom
Proton			
Neutron			
Electron			shell

6. There are two isotopes of hydrogen, 1-H, and 2-H, and the relative atomic mass of hydrogen is 1.01. Calculate the percentage of 1-H atoms in a sample of hydrogen.[2]

7. This query is about isotopes.

(a)Platinum Pt has an atomic number of 78.

- i. Please explain the concept of isotopes of Platinum?[1]

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- ii. Do Platinum isotopes with different atomic mass numbers exhibit similar chemical properties?[1]
-
-
-

- iii. Please fill in the table provided below with the relevant information regarding the atomic structure of $^{195.08}\text{Pt}$. [1]

Protons	Neutrons	Electrons

(b) The relative atomic mass of platinum (Pt) is 195.08

- i. Explain relative atomic mass. [3]
-
-
-

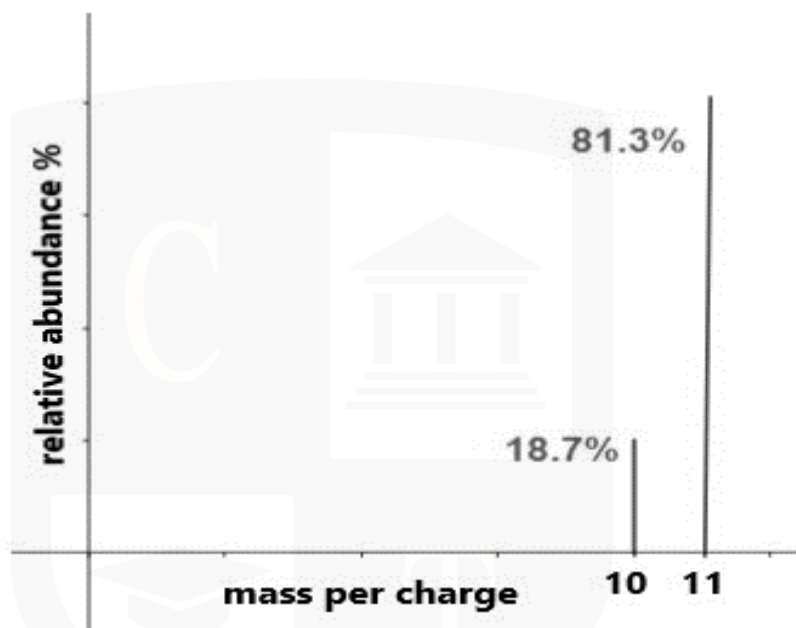
- ii. A sample of platinum, $A_r = 195.08$, was analysed and was found to consist of 90% ^{195}Pt and one other isotope.

Determine the mass number of the other isotope in the platinum sample. [1]

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8. A sample of element Y was analysed by mass spectrometry. The mass spectrum is shown below.



- i. Find the relative atomic mass of element Y. [2]

- ii. Suggest the identity of element Y. [1]

9. Holmium, atomic number 67, has two isotopes, ^{165}Ho and ^{166}Ho .

(a) Complete the table to show the number of protons, neutrons, and electrons in the $^{166}\text{Ho}^{3+}$ ion of holmium. [1]

	Protons	Neutrons	Electrons
$^{166}\text{Ho}^{3+}$			

(b) Atoms of holmium have electrons in orbitals within the first five shells. The first three shells of holmium are full.

Complete the table to show the number of electrons in the following regions of a holmium atom. [3]

	number of electrons
1s sub-shell	
a 3p orbital	
the 3rd shell	

10. This question is about fluorine, a Group 7 element, and how its relative atomic mass can be calculated using a mass spectrometer.

i. Discuss what the term "relative atomic mass of an element" means. [2]

ii. A sample of fluorine has a relative atomic mass of 18.99. The sample consists of

- 75.5% F-19
- 24.3% F-18
- one other isotope.

Please identify the other isotope of fluorine present in the sample.

11. Naturally occurring copper has two isotopes: ^{63}Cu (69.17%) with an isotopic mass of 62.9296 and ^{65}Cu (30.83%) with an isotopic mass of 64.9278.

i. Explain relative atomic mass. [3]

ii. Find the relative atomic mass of copper in this sample. [2]

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12. This question is about the elements with atomic numbers between 58 and 70.

Terbium, atomic number 65, is a metal.

Complete the table to show the relative charge of each particle and the number of each particle found in a $^{150.36}\text{Tb}^{2+}$ ion.

Particle	Charge	Number of each particle present in a $^{150.36}\text{Tb}^{2+}$ ion
proton		
neutron		
electron		

[2]



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