

## Trends in the Periodic Table Worksheet

1

While doing a research project, you noted the following information about five elements.

- Element A :
- . is a solid;
  - . conducts electricity;
  - . has 2 electrons in its outermost shell;
  - . has a low density.

- Element B :
- . has a very low density;
  - . does not conduct electricity;
  - . has 7 electrons in its outermost shell;
  - . is light green in colour.

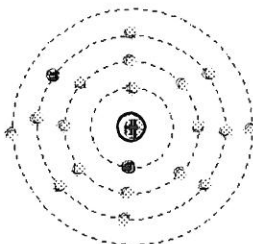
- Element C :
- . is found in very small quantities in nature;
  - . does not form compounds with other elements;
  - . is in a gaseous state;
  - . has a very low boiling point.

- Element D :
- . is a poor conductor of heat;
  - . is very hard;
  - . is non-ductile and non-malleable;
  - . conducts electricity.

- Element E :
- . is ductile and malleable;
  - . is a solid;
  - . is a good conductor of heat and electricity;
  - . has a low melting point.

Classify the elements above as metals, non-metals or metalloids. Explain

3 The simplified atomic model of an element is shown below.



What are, respectively, the Group and the Period of the Periodic Table to which the element belongs?

- A) II A and 4
- B) II A and 3
- C) IV A and 2
- D) IV A and 3

5

Which of the elements in the table below possess the properties of **shininess, electrical conductivity and malleability**?

- A) 1 and 2
- B) 1 and 4
- C) 2 and 3
- D) 3 and 4

6

An element is analyzed in the laboratory. It is a gas at room temperature that reacts strongly with metals.

Which letter represents the element and to which family in the table below does this element belong?

8

In a laboratory, a scientist noted the following facts about an element:

1. It is a solid.
2. It is a poor conductor of heat and electricity.
3. The nucleus of the atom of this element contains less than 18 protons.
4. The outermost electron shell contains 5 electrons.

What is this element?

Justify your answer by giving at least three arguments.

12

The element hydrogen has three isotopes :  ${}^1_1\text{H}$ ,  ${}^2_1\text{H}$  and  ${}^3_1\text{H}$ .

Which of the following statements is **false** ?

- A) The three atoms have the same number of protons.
- B) The three atoms have the same number of electrons
- C) The three atoms have the same number of neutrons.
- D) The three atoms have the same chemical properties.

13

In the Periodic Table, what is the relationship between the atomic mass of an element and its atomic number, Z ?

- A) In general, the atomic mass of an element decreases as the atomic number, Z, increases.
- B) In general, the atomic mass of an element increases as the atomic number, Z, increases.
- C) In general, there is no relationship between the atomic mass of an element and the atomic number, Z.
- D) In general, the atomic mass of an element increases by the same amount as the atomic number, Z.

14

Given the isotope of oxygen,  ${}^{18}_8\text{O}$ .

How many neutrons, electrons and protons does this atom have?

- A) 8 neutrons, 10 electrons and 10 protons.
- B) 8 neutrons, 18 electrons and 8 protons.
- C) 10 neutrons, 8 electrons and 8 protons.
- D) 18 neutrons, 8 electrons and 8 protons.

19

Six elements from the periodic table are described below.

- A. The lightest element
- B. A gas necessary for respiration

- C. A halogen whose electrons are distributed among three energy levels
- D. An element that belongs to Period 2 and that has three electrons on its outermost energy level
- E. An inert gas used to inflate balloons
- F. A metal necessary for the formation of bones and teeth

20

The properties of four elements are listed below.

ELEMENT	PROPERTIES
R	<p>It is not a metal.</p> <p>It exists in the gaseous state.</p> <p>It is often used as a disinfectant.</p> <p>It is pale green.</p>
S	<p>It exists in the gaseous state.</p> <p>It is very light.</p> <p>It is often used to inflate balloons.</p> <p>It does not burn.</p>
T	<p>It exists in the solid state.</p> <p>It is highly reactive.</p> <p>It is soft.</p> <p>It reacts vigorously with water.</p>
X	<p>It has a metallic luster.</p> <p>When heated in air, it burns, producing brilliant light and a white powder.</p> <p>It reacts readily with hydrochloric acid to produce hydrogen gas.</p>

To which family does each element belong?

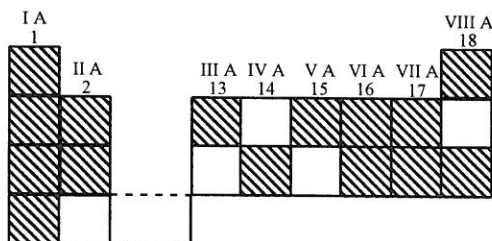
22

Which of the following statements is FALSE?

- A) Isotopes have similar chemical properties.

- B) Isotopes have the same number of protons.
- C) Isotopes have the same number of neutrons.
- D) Isotopes have the same number of electrons.

23 There are five unshaded boxes in the mini periodic table illustrated below.



Four of the five elements that appear in these boxes are described below.

- First element: Its third energy level contains 5 valence electrons.
- Second element: It is a gas that does not react with metals or nonmetals.
- Third element: It is an alkaline earth metal and one of the components of bones and teeth.
- Fourth element: It is a light metal that has 3 more electrons than an inert gas.

The description of the fifth element is missing. What is the name or symbol of the fifth element?

24 Properties of four elements are given below.

ELEMENT	PROPERTY
t	<ol style="list-style-type: none"> <li>1. It produces hydrogen gas when it reacts with an acid.</li> <li>2. It is a good conductor of heat.</li> </ol>
x	<ol style="list-style-type: none"> <li>1. It is not malleable.</li> <li>2. It has a metallic luster.</li> </ol>
y	<ol style="list-style-type: none"> <li>1. It has 6 valence electrons.</li> <li>2. It does not conduct electricity.</li> </ol>
z	<ol style="list-style-type: none"> <li>1. It is ductile.</li> <li>2. It reacts vigorously with water.</li> </ol>

Given these properties, to which category (metals, nonmetals or metalloids) does each element belong?

29 Potassium, K, and calcium, Ca, are located next to each other in the periodic table of elements.

These two elements belong to the same period, but not to the same family.

Explain why potassium and calcium belong to the same period, but not to the same family.

37 The organization of the Periodic Table can be explained in terms of electron arrangements. Which of these explanations is correct?

- A) An element that immediately precedes a noble gas always has its last electron in a new energy level. This means that the element is in a new Period.
- B) An element that immediately follows a noble gas always has its last electron in a new energy level. This means that the element is in a new Period
- C) An element that immediately follows a noble gas always has its last electron in the same energy level as the preceding noble gas. This means that the element is in a new Period
- D) An element that immediately follows a noble gas always has its last electron in a new energy level. This means that the element is in the same Period.

45 Complete the following sentence by choosing the correct response.

Fluorine, chlorine, bromine and iodine belong to the halogen family; they are all used for ....

- A) lighting.
- B) disinfecting.
- C) communication.
- D) heating.

47 The following table gives the description of four elements.

Element	Description
1	It is located in Period 1, has two electrons in its outermost energy level and may be used to inflate balloons.
2	It is located in Period 2, has one valence electron and reacts vigorously with water to form a base.
3	It is located in Period 2, has two completely filled energy levels and is chemically stable.
4	It is located in Period 3, has one less electron than the closest inert gas and may be used as a disinfectant.

Which of these elements belong to the same chemical family?

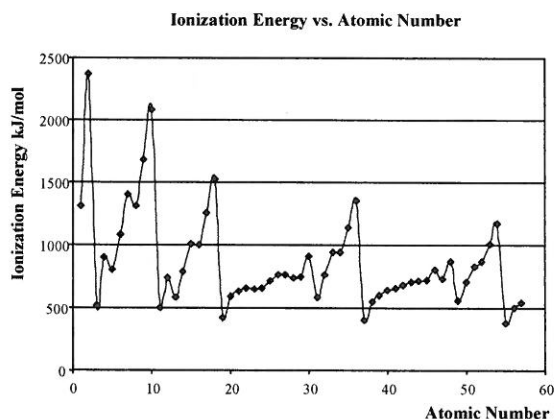
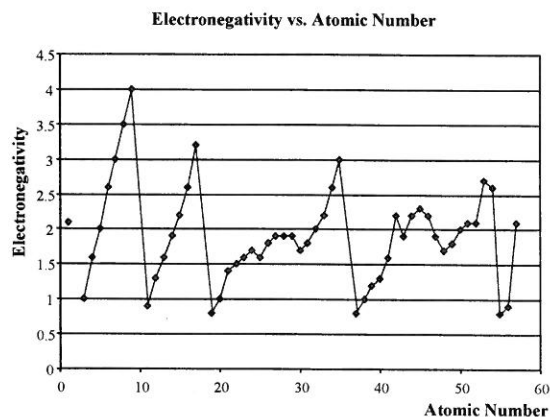
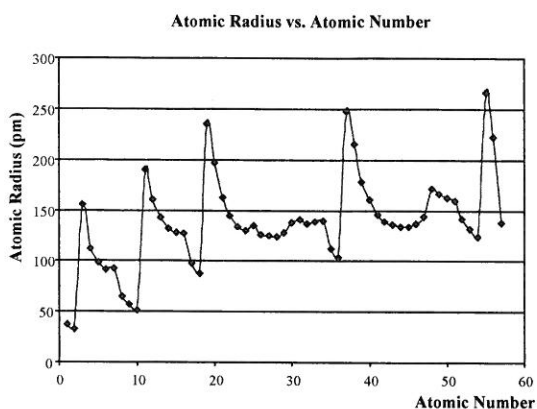
- A) 1 and 2
- C) 2 and 3

B) 1 and 3

D) 2 and 4

1

Consider the following graphs that compare the atomic radius, electronegativity, and ionization energy to atomic number.



Which table correctly describes the trends for atomic radius, electronegativity, and ionization energy within any given period of the periodic table?

A)	<b>PROPERTY</b>	<b>TREND</b>
	Atomic radius	Increases as atomic number increases
	Electronegativity	Increases as atomic number increases
	Ionization energy	Decreases as atomic number increases
B)	<b>PROPERTY</b>	<b>TREND</b>
	Atomic radius	Decreases as atomic number increases
	Electronegativity	Increases as atomic number increases
	Ionization energy	Increases as atomic number increases



C)

PROPERTY	TREND
Atomic radius	Decreases as atomic number increases
Electronegativity	Decreases as atomic number increases
Ionization energy	Increases as atomic number increases

D)

PROPERTY	TREND
Atomic radius	Decreases as atomic number increases
Electronegativity	Decreases as atomic number increases
Ionization energy	Decreases as atomic number increases

52

Richard recorded data on the three stable isotopes of a newly discovered element. Unfortunately, a coffee spill in the late hours of the night resulted in smudged data. Richard was able to recover data on the average atomic mass (24.72 a.m.u.), as well as data on the first two isotopes in the chart below.

Isotope	Natural abundance (%)
$^{24}\text{W}$	78.99
$^{26}\text{W}$	11.01
$^{\text{?}}\text{W}$	?

What is the atomic mass of the missing isotope?

53

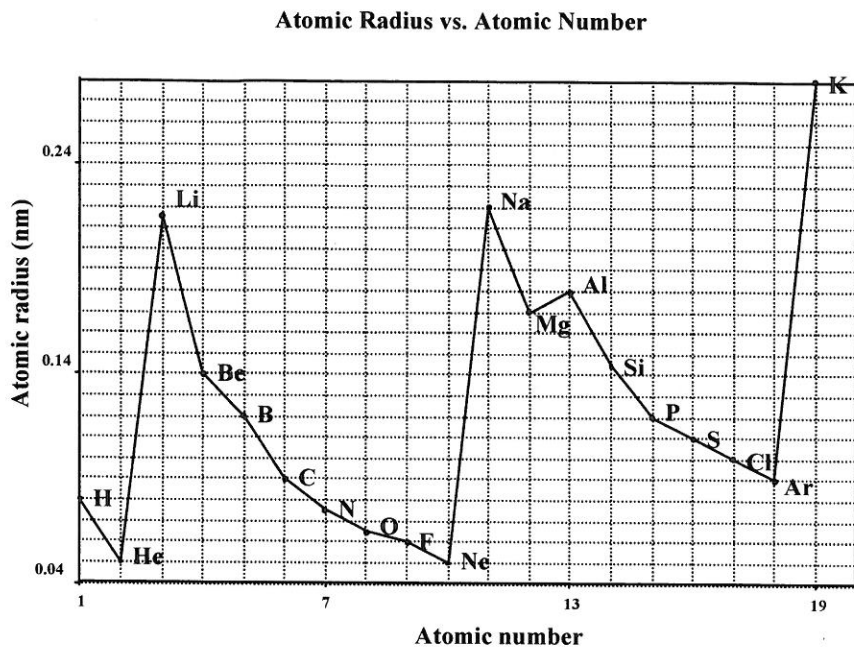
Two isotopes of boron, B, are found in nature. The relative abundance of Boron 11 is 80.22 %. The second isotope of boron has one less neutron than Boron 11.

Calculate the average atomic mass of boron.



54

Consider the graph below.

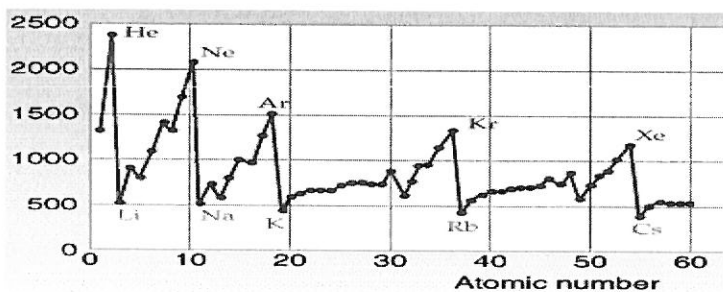


Based on this graph, which of the following statements is correct?

- A) The atomic radius increases across the period and decreases down a group.
- B) The atomic radius decreases across the period and increases down a group.
- C) The atomic radius increases across the period and increases down a group.
- D) The atomic radius decreases across the period and decreases down a group.

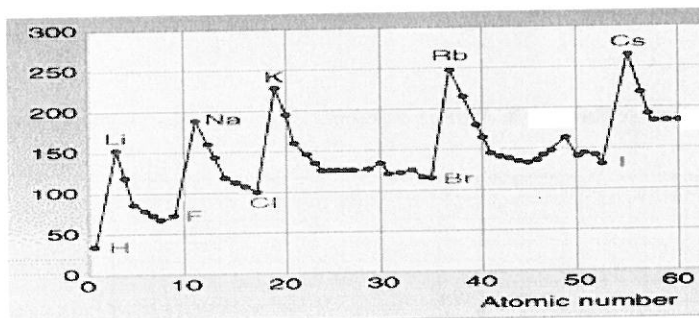
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The following graphs illustrate various trends of the atoms on the periodic table.

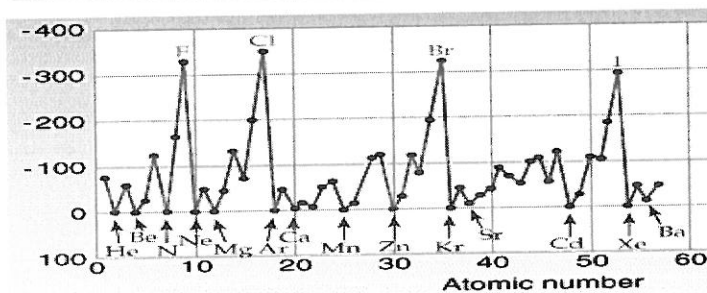


I

II



III



Which graphs represent the trend for ionization energy and for atomic radius?

- A) Ionization energy - I  
Atomic radius - II
- B) Ionization energy - III  
Atomic radius - II
- C) Ionization energy - II  
Atomic radius - III
- D) Ionization energy - I  
Atomic radius - III

56

Iron has four isotopes, as shown in the table below.

Complete the table, and calculate the average atomic mass of iron, Fe.

Isotope	% Abundance	Number of neutrons	Number of protons	Mass of isotope
1	5.8%			54 $\mu$
2	91.7%			56 $\mu$
3				57 $\mu$
4	0.33%			58 $\mu$

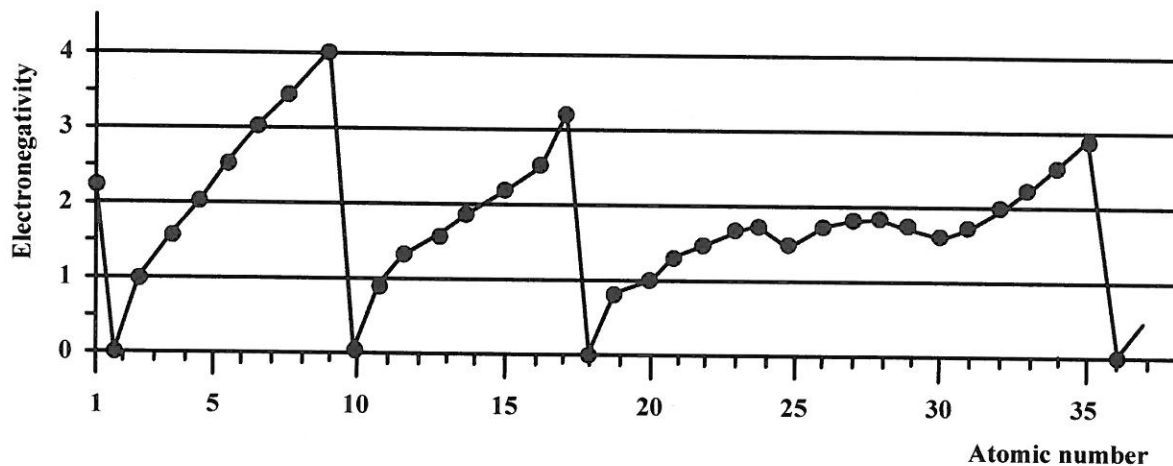
- 59 The table below provides certain information about the symbol, the electron configuration, the name of the chemical family and the period number of four elements in the periodic table.

Symbol	Electron configuration	Name of the chemical family	Period number
Mg			
		Alkali metals	2
	• )2e <sup>-</sup> )3e <sup>-</sup>		
	• )2e <sup>-</sup>		

Using the above information and the periodic table, fill in the empty boxes.

- 61 The graph below shows the electronegativity of some elements.

Describe: the progression of this property for elements within the 3rd period on the periodic table.



- 62 In parts of the periodic table, as the atomic number increases, the atomic mass decreases. Argon (Ar) and potassium (K) are examples of this.

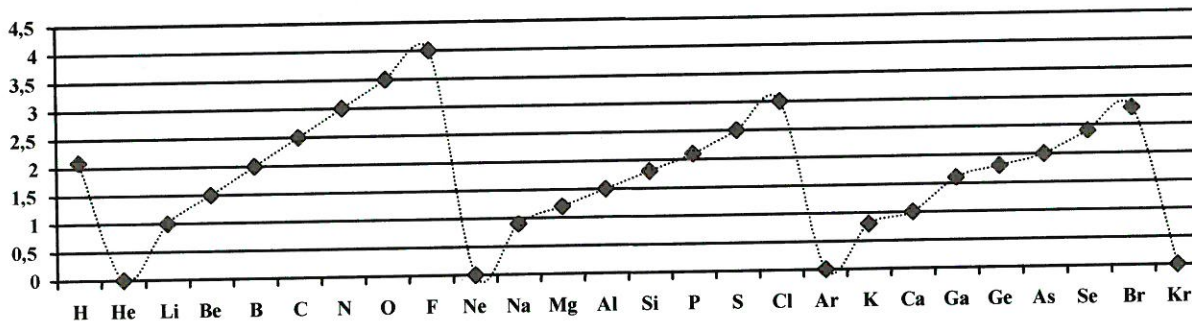
Which of the following statements helps to explain this irregularity?

- A) The radius of an atom increases with the period number.
- B) The atomic mass of alkali metals is smaller than that of inert gases.
- C) The number of isotopes differs from one element to another.
- D) The atomic number corresponds to the number of protons of the atom.

63 Which of the following elements has the greatest atomic radius?

- A) Boron (B)
- B) Lithium (Li)
- C) Neon (Ne)
- D) Nitrogen (N)

64 The graph below shows the electronegativity index of some elements of the periodic table.



Which of the following statement is true?

- A) The electronegativity index steadily increases within the same family.
- B) The electronegativity index steadily increases, then drops to 0 within the same period.
- C) The electronegativity index remains constant within the same family period as one goes from left to right on the periodic table.
- D) The electronegativity index steadily decreases within the same period.

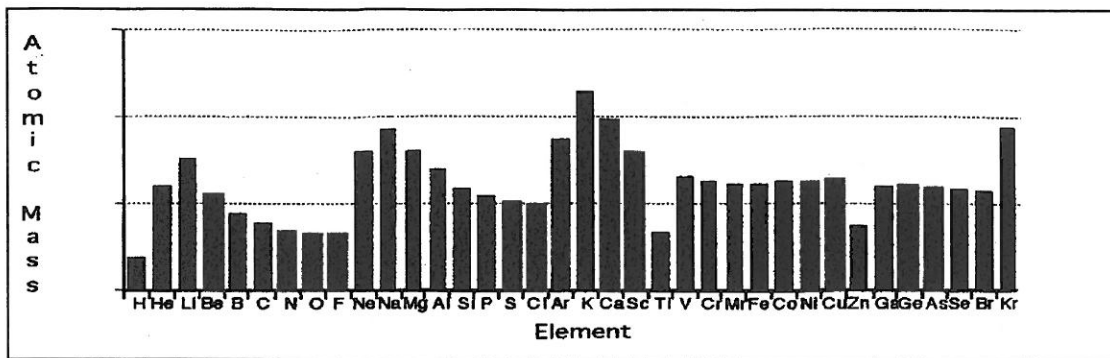
65 There are three natural isotopes of element X. The following table shows the relative abundance of each isotope of this element, as well as their mass in atomic mass unit, amu.

Isotope	Mass (amu)	Relative abundance (%)
X(42)	42	80
X(44)	44	15
X(48)	48	5

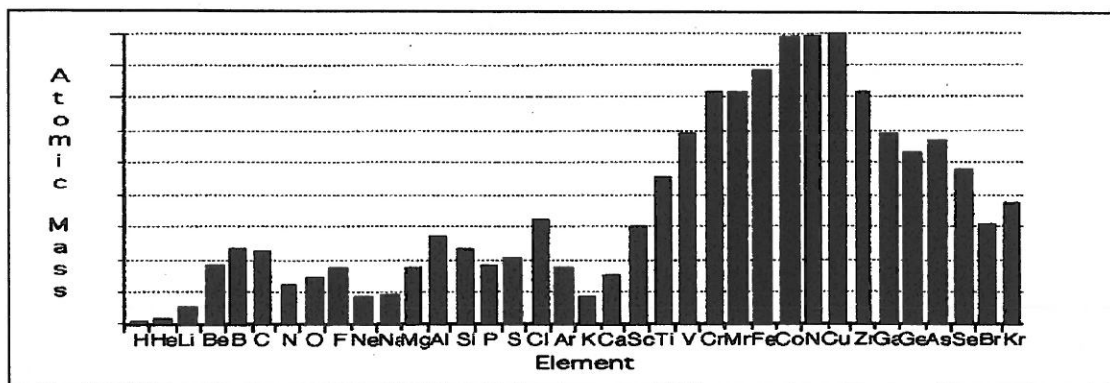
What is the atomic mass of element X?

Which one of the following graphs represents the progression of the atomic masses in the periodic table?

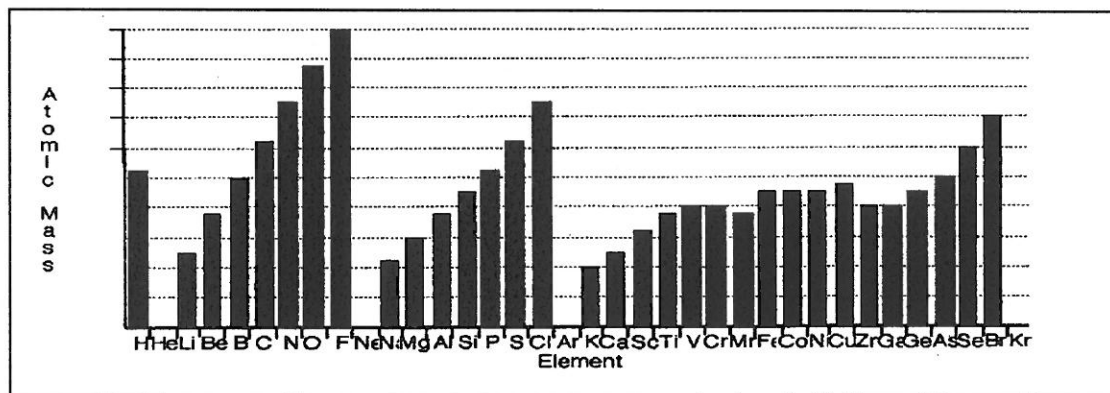
A)



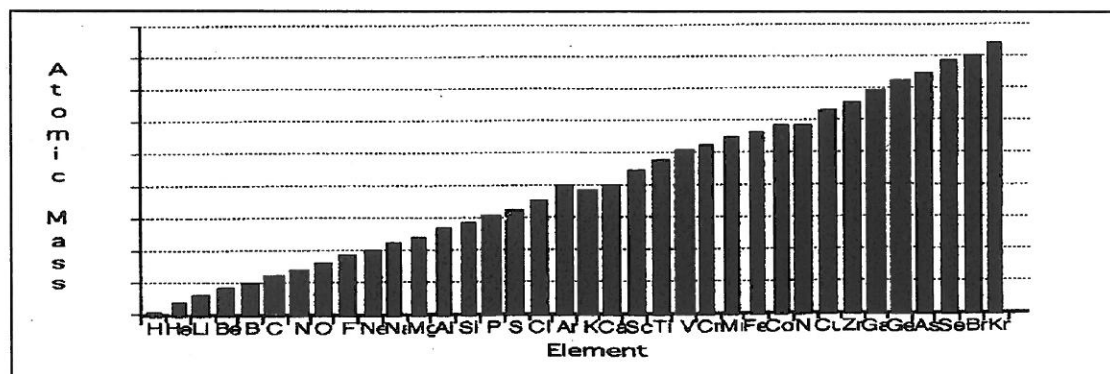
B)



C)



D)



67 Listed below are three isotopes of element X :

Isotope	Mass Number	Percentage Abundance
1	32	95.0%
2	33	0.76%
3	34	4.22%

What is the atomic mass of element X?

68 Element X has three stable isotopes and an atomic number of 10.

Isotope	Number of Neutrons	Relative abundance (%)
1	10	95.92
2	11	0.26
3	12	?

Which of the following represents the atomic mass of element X?

69 Element «X» has two isotopes.

Isotope	Mass number	Atomic number
I	63	29
II	65	29

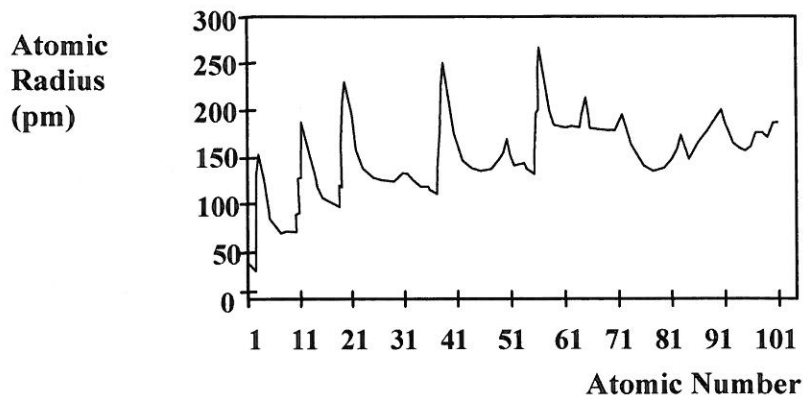
The isotope with 36 neutrons has an abundance of 30.9%.

What is the average atomic mass for this element?

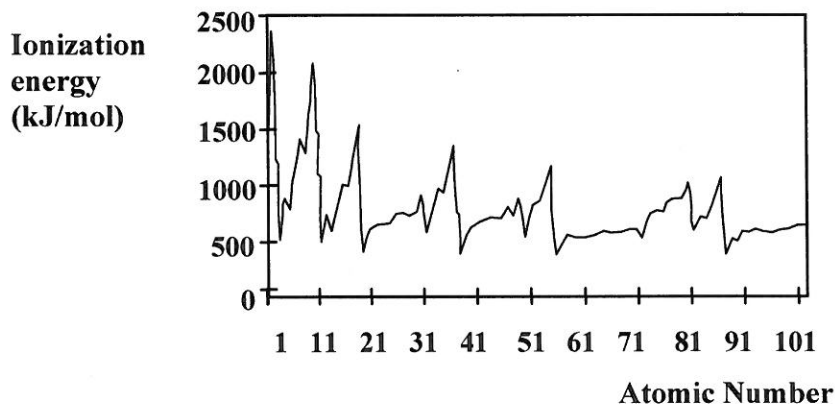


Based on the graphs below, in general terms what happens to the atomic radius and ionization energy as the atomic number increases across a given period?

**Atomic Radius vs. Atomic Number**



**Ionization Energy vs. Atomic Number**



- A) As the atomic number increases, both the atomic radius and ionization energy generally increase.
- B) As the atomic number increases, both the atomic radius and ionization energy generally decrease.
- C) As the atomic number increases, the atomic radius generally increases and the ionization energy generally decreases.
- D) As the atomic number increases, the atomic radius generally decreases and the ionization energy generally increases.

71

The atomic mass of an element varies irregularly from one element to the next in the periodic table.

Which of the following is the reason that the atomic mass varies irregularly?

- A) The number of protons increases irregularly from one element to the next.
- B) The number of neutrons increases irregularly from one element to the next.
- C) The atomic number increases irregularly from one element to the next.
- D) The number of electrons increases irregularly from one element to the next.

72

Which of the following statements are true for the atomic radius within the same period?

- I) Moving from left to right across a given period, there is an increase in the number of electrons, protons and neutrons, and thus the atomic radius increases.
- II) The atomic radius decreases with the increasing atomic number across a given period.
- III) The atomic radius is independent from the type of atom within a given period.
- IV) Moving from left to right across a given period, there is an increase in the number of protons and electrons. Therefore the electric forces between nucleus and shell increases, thus reducing the atomic size.

**Choices:**

- A) I and III
- B) I, II and IV
- C) II and III
- D) II and IV