

# Periodic Classification of Elements

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## 1 Mark Questions

**1. Arrange the following in descending atomic size Na, Mg, K**

**Ans.** K, Na, Mg

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**2. Give the name and electronic configuration of second alkali metal?**

**Ans.** Sodium (Na) (2, 8, 1)

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**3. What is the similarity in the electronic configuration of Mg, Ca and Sr?**

**Ans.** All the elements have two electrons in their valence shell.

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**4. Which is bigger in size Na, Na<sup>+</sup>**

**Ans.** Na

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**5. Name three elements which behave as metalloids?**

**Ans.** Arsenic (As), Antimony (Sb), Germanium (Ge)

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**6. Which of the following has maximum atomic size?**

(a) K

(b) Ca

(c) Al

(d) P

**Ans. (a) K**

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**7. The law of octaves was proposed by**

- (a) Newland**
- (b) Doberiener**
- (c) Lothar Meyer**
- (d) Mendleeve**

**Ans. (a) Newland**

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**8. The number of periods in the long form of the periodic table is**

- (a) 6**
- (b) 7**
- (c) 10**
- (d) 18**

**Ans. (b) 7**

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**9. Which of the following elements has maximum metallic character?**

- (a) Li**
- (b) N**
- (c) Na**
- (d) P**

**Ans. (c) Na**

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**10. Which of the following is the most reactive halogen?**

- (a) F**

(b) Cl

(c) Br

(d) I

Ans. (a) F

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11. Besides gallium, which other elements have since been discovered that were left by Mendeleev in his Periodic Table? (any two)

Ans.  $K_2O$ ,  $CO_2$ ,  $SiO_2$ ,  $BaO$

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12. Which of the following statements is not correct statement about the trends when going from left to right across the periods of Periodic Table?

(a) The elements become less metallic in nature.

(b) The number of valance electrons increases.

(c) The atoms lose their electrons more easily.

(d) The oxides becomes more acidic.

Ans. (c) The atoms lose their electrons more easily.

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13. Element X forms a chloride with the formula  $XCl_2$  which is a solid with a high melting point. X would most likely be in the same group of the Periodic Table as

(a) Na

(b) Mg

(c) Al

(d) Si

Ans. (b) Mg

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**14. X, Y and Z are the elements of a Dobereiner's triad. If the atomic mass of x is 7 and that of z is 39, what should be the atomic mass of y?**

**Ans.**  $(7+39)/2 = 23$ .

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**15. A and B are the two elements having similar properties which obey Newland's law of octaves. How many elements are there in between A and B?**

**Ans.** Six elements.

## **2 Mark Questions**

**1. Alkali metals do not form dipositive ions why?**

**Ans.** Alkali metals present in Group 1 so 17 has only one valence electron. By losing one  $e^-$  They acquire the configuration of the noble gas element and hence do not form dipositive ions.

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**2. Why non-metals are called electro negative elements?**

**Ans.** Non-metals are called electronegative elements since their atoms form negative ions by accepting electrons

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**3. How were the positions of different isotopes decided in the modern periodic table?**

**Ans.** All the isotopes have same atomic numbers in modern periodic table the elements have been allotted places based on their atomic numbers. Therefore, all the isotopes of an element have been assigned the same position in the modern periodic table.

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**4. Hydrogen is regarded as a rogue element in the periodic table. Discuss.**

**Ans.** Hydrogen is regarded as a rogue element in the periodic table because till today its position is not satisfactory. Although it has been placed on the top of alkali metals on the basis of electronic configuration, but it is non-metal and also resembles halogens of group 17.

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**5. Why do elements in a group show same valency?**

**Ans.** The valency of an element is related to the valence shell electronic configuration of its atom. Since the elements present in a group have the same valence shell electronic configuration. They show the same valency.

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**6. Why are the members of group 1 known as alkali metals?**

**Ans.** All the elements in group 1 are known as alkali metals because they react with water to form soluble hydroxides that are called alkalis.

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**7. How does metallic character of the elements vary (i) In a group (ii) In a period?**

**Ans. (i)** The metallic character of the elements increases downwards in a group  
**(ii)** The metallic character of the elements decreases from left to right in a period.

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**8. Name other elements which belong to the same family as**

**(i) Calcium (ii) Carbon.**

**Ans. (i)** Magnesium, Strontium

**(ii)** Silicon, Germanium.

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**9. Did Dobereiner's triads also exist in the columns of Newland's Octaves?**

**Compare and find out?**

**Ans.** Yes, following triads can be identified:

Li, Na, K

Be, Mg, Ca

The atomic mass of middle atom in the above triads is approximately equal to the average mass of elements on the left and right hand side.

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**10. What were the limitations of Dobereiner's classification?**

**Ans.** Debereneiner could identify only three triads from the elements known at that time. Hence, this classification of elements was not found to be useful.

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**11. Besides gallium, which other elements have since been discovered that were left by Mendeleev in his Periodic Table? (any two)**

**Ans.** Scandium and Germanium.

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**12. How could the Modern Periodic table remove various anomalies of Mendeleev's Periodic Table?**

**Ans.** Modern Periodic Table settled the placement of isotopes as isotopes have same atomic number.

Position of controversial position of hydrogen is also settled in modern periodic table.

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**13. Name two elements you would expect to show chemical reactions similar to magnesium. What is the basis for your choice?**

**Ans.** Calcium and Strontium would show chemical reactions similar to magnesium. They have the same number of electrons in the outermost shell.

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**14. In the Modern Periodic Table, which are the metals among the first ten elements?**

**Ans.** Lithium and Beryllium are the metals among the first ten elements in the Modern Periodic Table.

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**15. (a) What property do all elements in the same column of the Periodic Table as boron have in common?**

**(b) What property do all elements in the same column of the Periodic Table as Fluorine have common?**

**Ans. (a)** All the elements in the in the same column as boron have three electrons in the valence shell. That is all the elements are trivalent.

**(b)** All the elements in the same column as fluorine has one electron in the valance shell, which is all the elements, are monovalent.

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**16. An atom has electronic configuration 2, 8, 7.**

**(a) What is the atomic number of this element?**

**(b) To which of the following elements would it be chemically similar?**

**(Atomic numbers are given in parentheses.)**

**N(7), F(9), P(15), Ar(18)**

**Ans.** Chlorine has the electronic configuration 2, 8, 7.

(a) Atomic number of element is 17.

(b) F (9)

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**17. Nitrogen (atomic number 7) and phosphorus (atomic number 15) belong to group 15 of the Periodic Table. Write the electronic configuration of these two elements. Which of these will be more electronegative? Why?**

**Ans.** Nitrogen atomic number 7 has got 7 electrons with electronic configuration 2, 5.

Phosphorus with atomic number 15 has got 15 electrons with electronic configuration 2, 8, 5.

Non-metallic character decreases as we move down the group. Therefore, nitrogen will be more electronegative than phosphorus.

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**18. In the modern Periodic Table calcium (atomic number 20) is surrounded by elements with atomic number 12, 19, 21 and 38. Which of these have physical and chemical properties resembling calcium?**

**Ans.** Elements in a group have similar properties. Elements with atomic numbers 12 and 38 lie in the same group as calcium. Therefore, they will have properties resembling calcium.

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**19. A metal M forms an oxide having the formula  $M_2O_3$ . It belongs to 3 period in the modern periodic table. Write the atomic number and valency of the metal.**

**Ans.** Atomic number=13

Valency = 3



### 3 Mark Questions

**1. Calcium is an element with  $Z = 20$**

**(a) Is it a metal or a non-metal?**

**(b) Will its size be bigger or smaller than that of potassium?**

**(c) write the formula of its chloride**

**Ans.**  $Z = 20$  is 2, 8, 8, 2

**(i)** It is a metal which has two valence electrons it is present in group 2

**(ii)** Both potassium (K) and calcium (Ca) are present in fourth period. Since atomic size decreases along a period calcium is smaller in size.

**(iii)** The valency of calcium is 2 and its formula.

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**2. (a) Name the elements present in the third period and classify them into metals and non-metals.**

**(b) On which side of the table do you find the metals?**

**(c) On which side of the table do you find the non-metals?**

**Ans. (a)** The elements are

Na, Mg, Al, Si, P, S, Cl, Ar

**(b)** The metals are placed mostly on the left side of the table.

**(c)** The non-metals are placed on the right side of the table.

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### 3. Table is a part of periodic table

H							He
Li	BE	B	C	N	O	F	Ne
Na	Mg	Al	Si	P	S	Cl	Ar

Use this table and explain why

(a) Li and Na are considered as active metals

(b) Atomic size of Mg is less Than that of Na

(c) Fluorine is more reactive than chlorine.

**Ans. (a)** Both Li and Na are active elements since their atoms have only one electron in their valence shells. They readily lose this electron to have the configuration of the nearest noble gas element.

**(b)** Mg is placed after Na is the same period (third). As the atomic size decreases along a period, the size decreases along a period. The size of Mg is less than that of Na.

**(c)** Both F and Cl belong to Group 17. Since fluorine is more electronegative than chlorine, it is therefore more reactive also.

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### 4. Write two major shortcomings of Mendeleev's periodic table? How have these been removed in the modern periodic table?

**Ans.** The two major short comings of Mendeleev's periodic table were

(i) It could not justify the position of hydrogen in the periodic table

(ii) It could not assign proper position to the different isotopes of the same element

The main reason for these short comings was the basis of the Mendeleev's periodic table. It regarded atomic masses of the elements as the basis of classification. The modern periodic table regards atomic numbers of the elements as the basis of classifying the elements. It removed both the short comings from the table.

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**5. How would tendency to gain electrons change as you go down in a group?**

**Ans.** It is expected to decrease since atomic size increases down the group and the tendency of the element to gain electron decreases.

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**6. Two elements X and Y belong to Group 1 and Group 2 respectively in the same period. Compare them with respect to:**

- (a) The number of valence electrons**
- (b) Valency**
- (c) metallic character**
- (d) Size of the atoms**
- (e) Formulae of their oxides and chlorides.**

**Ans. (a)** The valence electrons present in element X (group 1) and element Y (group 2) are 1 and 2 respectively.

**(b)** The valency of the element X is one while that of the element Y is two.

**(c)** Metallic character decreases along a period. This means that element X is more metallic as compared to element Y.

**(d)** Atomic size decreases along a period. As a result, the element Y has a smaller size than the element X.

**(e)** For element X Oxide ( $X_2O$ ), chloride (XCl)

For element Y Oxide (YO) and chloride ( $YCl_2$ )

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**7. The following table shows the position of six elements A, B, C, D, E and F in the period table.**

Groups Periods	1	2	3 to 12	13	14	15	16	17	18
2	A					B		C	
3		D			E			F	

Using the table answer the following

- Which element will form only covalent compounds?
- Which element is a metal with valency 2.
- Which element is a non-metal with valency 3.
- Out of D and E which has bigger atomic radius and why?
- Write a common name for the family of elements C and F

**Ans.** (a) Element (E) and its name is silicon

(b) Element D and name is magnesium (Mg) if exhibits valency 2

(c) Element B is non-metal and name is nitrogen (N) and exhibits valency 3.

(d) Element D has bigger atomic radius than E as size decreases along a period.

(e) Element C and f are noble gases.

## 8. What were the limitations of Newland's law of octaves?

**Ans.** The limitations of Newlands' Law of Octaves:

(a) it was found that Law of Octaves was applicable only upto calcium.  
After calcium eighth element did not possess properties similar to that of first.

(b) Newlands' assumed that only 56 elements existed in nature and no more elements would be discovered in future.

(c) To fit the element into his table, Newlands adjusted two elements in the same slot but also put some unlike elements under the same note.

## 9. What were the criteria used by Mendeleev in creating his Periodic table?

**Ans.** Mendeleev created his Periodic Table on the basis of their fundamental property the atomic mass and also on the similarities of chemical properties. Among chemical properties he concentrated on the compounds formed by elements with oxygen and hydrogen.

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**10. Name:**

**(a) Three elements that have a single electron in their outermost shells.**

**(b) Two elements that have two electrons in their outermost shells.**

**(c) Three elements with filled outermost shells.**

**Ans. (a)** Lithium, sodium and potassium have a single electron in their outermost shells.

**(b)** Magnesium and calcium have two electrons in their outermost shells.

**(c)** Helium, neon and argon have filled outermost shells.

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**11. (a) Lithium, sodium and potassium are all metals that react with water to liberate hydrogen gas. Is there any similarity in the atoms of these elements?**

**(b) Helium is an un-reactive gas and neon is a gas of extremely low reactivity.**

**What, if anything, do their atoms have in common?**

**Ans. (a)** Lithium, sodium and potassium have same number of electrons in the outermost shell.

**(b)** Helium and argon have completed outermost shell, 2 electrons in case of helium and 8 electrons in case of argon.

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**12. By considering their position in the Periodic Table, which one of the following elements would you expect to have maximum metallic characteristic?**

**Ga, Ge, As, Se, Be**

**Ans.** Metallic character of an element increases down a group and decreases from left to right in period. On this basis Be is expected to have maximum metallic character.

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**13. Which element has**

- (a) two cells, both of which are completely filled with electrons?**
- (b) the electronic configuration 2, 8, 2?**
- (c) a total of three shells, with four electrons in its valance shell?**
- (d) twice as many electrons in its second shell as in its first shell?**

**Ans. (a)** Neon

**(b)** Magnesium

**(c)** Silicon

**(d)** Carbon

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**14. The position of three elements A, B and C in the Periodic Table are shown below:**

<b>Group 16</b>	<b>Group 17</b>
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-----	<b>A</b>
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<b>B</b>	<b>C</b>

- (a) State whether A is a metal or non-metal.**
- (b) State whether C is more reactive than A**
- (c) Will C be larger or smaller in size than B?**
- (d) Which type of ion, cation or anion, will be formed by element A?**

**Ans. (a)** A is a non-metal.

**(b)** C is less reactive than A.

(c) C will be smaller than B.

(d) A will form anion.

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**15. How does the electronic configuration of an atom relate to its position in the Modern Periodic Table?**

**Ans.** Group number on an element can be predicted from the number of electrons in the outermost shell.

Period number of an element can be predicted from the number of shells with filled electrons.

Knowing the electronic configuration, we can find the number of electrons in the outermost shell and the number of shells with filled electrons. This can help to relate its position in the Periodic Table.

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**16. Compare and contrast the arrangement of elements in Mendeleev's Periodic Table and the Modern Periodic Table.**

**Ans.**

Similarities	Dissimilarities
a. In both tables, physical and chemical properties has been taken basis for classification and kept in same group. b. The formulae of the oxide and hydrides formed by an element were treated as one of the criteria for classification of elements.	a. While Mendeleev's Table was based on the atomic mass but modern Periodic table is based on atomic number. b. Mendeleev's Table contain 6 periods and 8 groups but modern periodic table contain 7 periods and 18 groups. c. Transition elements have been placed at the end of Mendeleev's periodic table but in modern periodic table they are placed in the middle.

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**17. The following is Newland's Octave Table. Observe it and answer the following questions:**

Sa(do)	Re(re)	Ga(mi)	Ma(fa)	Pa(so)	Da(la)	Ni(ti)
H	Li	Be	B	C	N	O
F	Na	Mg	Al	Si	P	S
Cl	K	Ca	Cr	Ti	Mn	Fe
Co and Ni	Cu	Zn	Y	In	As	Se
Br	Rb	Sr	Ce and La	Zr	-	-

**(a) Which of the element in 1<sup>st</sup> column has different properties from rest of the elements?**

**(b) Which of the elements resemble with each other in second column?**

**(c) Pick up odd element in second last column.**

**(d) Pick up elements which have similar properties in last column.**

**Ans. (a) Co & Ni**

**(b) Li, Na, K**

**(c) Mn**

**(d) O, S Se**



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**18. In the Periodic Table given below, Lithium, carbon, oxygen and neon are placed in their correct positions and the positions of nine other elements are represented by letters. These letters are not the symbols for the elements?**

1	2	13	14	15	16	17	18
Lithium			Carbon		Oxygen	L	Neon
X			E		G	Q	
Y						R	
Z						T	

**By reference to the table, answer the following questions:**

- (a) Give the letter of the most reactive metal.**
- (b) Give the letter of the most reactive non-metal.**
- (c) Name the family of elements represented by L, Q, R and T.**
- (d) Name one element in each case occurring in groups 2, 13 and 15**

**Ans. (a) Z**

**(b) L,**

**(c) Halogen family,**

**(d) Mg(group-2), Al (group-13), N (group-15)**

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**19. Two elements X and Y have atomic numbers 12 and 16 respectively. Write the electronic configuration for these elements. To which period of the modern periodic table do these two elements belong? What type of bond will be formed between them and why?**

**Ans. X(Z=12): 2, 8,2 Y (Z16): 2,8,6**

Both these elements are present in third period. An ionic bond is formed between X & Y as a result of transfer of two electrons from X to Y

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**20. An element X (2,82) combines separately with NO and  $(SO_4)^{2-}$ ,  $(PO_4)^{3-}$  radicals. Write the formulae of the three compounds so formed. To which group of the periodic table does the element 'X' belong? Will it form covalent or ionic compound? Why?**

**Ans.**  $X(NO_3)_2$  :  $XSO_4$  :  $X_3(PO_4)_2$

X belongs to second group X forms ionic compound because by losing two electrons X achieves the electronic configuration of Noble gas element Neon.

**21. The following table shows the position of six elements A, B, C, D, E and F in the periodic table.**

Groups/ periods	1	2	3 to 12	13	14	15	16	17	18
2.	A					B			C
3.		D			E				F

**Using the above table answer the following questions:**

- Which element will form only covalent compounds?
- Which element is a metal with valency 2?
- Which element is a non-metal with valency of 3?
- Out of D and B, which one has a bigger atomic radius and why?
- Write a common name for the family of elements C and F.

**Ans. (a)** E,

**(b)** D,

**(c)** B,

**(d)** D, because the atomic size decreases along a period,

**(e)** Noble Gases.

[illegible]

**i Write the atomic numbers of the elements.**

### ii Give the electronic distribution of the elements

**iii Using these three elements as examples, describe the trend in chemical properties across the third period of the Periodic Table.**

**Ans. (a)**  $\text{Na} = 11$

C1 = 17

$$\mathbf{Ar} = 18$$

(b)Na(2,8,1) C1(2,8,7) Ar(2,8,8)

**(c) Metallic and reducing character decreases.**

23.

Group	I	II	III	IV	V	VI	VII	VIII
Oxide	R <sub>2</sub> O	RO	R <sub>2</sub> O <sub>3</sub>	RO <sub>2</sub>	R <sub>2</sub> O <sub>5</sub>	RO <sub>3</sub>	R <sub>2</sub> O <sub>7</sub>	RO <sub>4</sub>
Hydride	RH	RH <sub>2</sub>	RH <sub>3</sub>	RH <sub>4</sub>	RH <sub>3</sub>	RH <sub>2</sub>	RH	
Periods	A B	A B	A B	A B	A B	A B	A B	
1	H							
2	Li	Be	B	C	N	O	F	
3	Na	Mg	Al	Si	P	S	Cl	
4. First Series:	K	Ca	Sc	Ti	V	Cr	Mn	Fe Co Ni
Second Series:	Cu	Zn	Ga	Ge	As	Se	Br	
5 First Series:	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru Rh Pd
Second Series:	Ag	Cd	In	Sn	Sb	Te 127.90	I 126.90	
6 First Series:	Cs	Ba	La	Hf	Ta	W		Os Ir Pt
Second Series:	Au	Hg	Tl	Pb	Bi			

(a) Write the formula of hydride and oxide of silicon

(b) Name the elements which is in

(i) II group and 4<sup>th</sup> period

(ii) VI group and 3<sup>rd</sup> period.

(c) Name the elements in group I which do not resemble with alkali metals

(d) In group VI why does Te with atomic mass 127.60 comes before I with atomic mass 126.90

Ans. (a)  $SiO_2$ ,  $SiH_4$

(b) (i) Ca, Zn

(ii) S

(c) H

(d) The sequence was inverted so that elements with similar properties could be grouped together.