



CHEMISTRY

NCERT - NCERT CHEMISTRY(ENGLISH)

CLASSIFICATION OF ELEMENTS AND PERIODICITY IN PROPERTIES

Solved Example

1. What would be the *IUPAC* name and symbol for the element with atomic number

120?



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2. How would you justify the presence of 18 elements in the 5th period of the periodic table?



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3. The elements $Z = 117$ and 120 have not yet been discovered, In which family/group

would you place these elements and also give the electronic configuration in each case.



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4. Considering the atomic number & position in the periodic table, arrange the following elements in the increasing order of metallic character: *Si*, *Be*, *Mg*, *Na*, *P*.



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5. Which of the following species will have the largest and the smallest size

Mg, Mg^{2+}, Al, Al^{3+} ?



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6. The first ionization enthalpy ($\Delta_t H$) values of the third period elements, Na, Mg and Si are respectively 496, 737 and $786 kJ mol^{-1}$.

Predict whether the first $\Delta_t H$ value for Al will

be more close to 575 or 760kJmol^{-1} ? Justify your answer.



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7. Which of the following will have the most negative electron gain enthalpy and which the least negative? P, S, Cl, F . Explain your answer.



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8. Using the periodic table, predict the formulas of compounds which might be formed by the following pairs of elements : (a) silicon and bromine (b) aluminium and sulphur.



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9. Are the oxidation state and covalency of Al in $[AlCl(H_2O)_5]^{2+}$ same ?



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10. Show by a chemical reaction with water that Na_2O is a basic oxide and Cl_2O_7 is an acidic oxide.



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Exercise

1. What is the basic theme of organisation in the periodic table?



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2. Which important property did Mendeleev use to classify the elements in his periodic table and did he stick to that?



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3. What is the basic difference in approach between the Mendeleev's periodic law and the Modern periodic law?



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4. On the basis of quantum number, which period of the periodic table should have 32 elements.



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5. In terms of block, period and group, where would you locate the element with $Z = 114$ in Modern periodic table?



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6. Write the atomic number of the element present in the third period and seventeenth group of the periodic table.



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7. Which element do you think would have been named by (a) Lawrence Berkeley laboratory and (b) Seaborg's group?



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8. Why do elements with similar properties occur in the same group?



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9. What do atomic radius and ionic radius really mean to you?



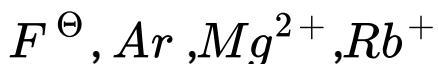
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10. How do atomic radii vary (a) down the group and (b) along the period from left to right?



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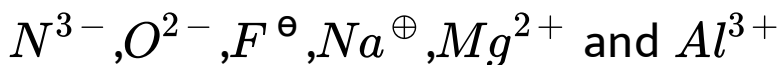
11. What do you understand by isoelectronic species? Name a species that will be isoelectronic with each of the following atoms or ions.





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12. Consider the following species:



a. What is common in them?

b. Arrange them in the order of increasing ionic radii.



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13. Explain why cations are smaller and anions larger in radii than their parent atoms?



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14. What is the significance of the terms- 'isolated gaseous atom' and 'ground state' while defining the ionisation enthalpy and electron gain enthalpy?

Hint: Requirements for comparison purposes.



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15. Energy of an electron in the ground state of the hydrogen atom is $-2.18 \times 10^{-18} J$.

Calculate the ionisation enthalpy of atomic hydrogen in terms of $Jmol^{-1}$.

Hint: Apply the idea of mole concept to derive the answer.



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16. Among the second period elements the actual ionisation enthalpies are in the order

$Li < B < Be < C < O < N < F < Ne.$

Explain why (a) Be has higher $\Delta_i H$ than B and

(b) O has lower $\Delta_i H$ than N and F?



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17. How would you explain the fact that the first ionisation enthalpy of sodium is lower than that of magnesium but its second ionisation enthalpy is higher than that of magnesium?



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18. What are the various factors due to which the ionisation enthalpy of the main group elements tends to decrease down a group?



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19. The first ionisation enthalpy of group 13 elements are :

Element	Boron	Aluminium	Gallium	Indium	Thallium
Symbol	B	Al	Ga	In	Tl
IE_1 (kJmol^{-1})	801	577	579	558	589

Explain this deviation from the general trend.



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20. Which of the following pairs of elements would have a more negative electron gain enthalpy?

a. O or F , b. F or Cl



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21. Would you expect the second electron gain enthalpy of O as positive, more negative or

less negative than the first? Justify your answer.



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22. What is the basic difference between the terms electron gain enthalpy and electronegativity?



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23. How would you react to the statement that the electronegativity of N on Pauling scale is 3.0 in all the nitrogen compounds?



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24. Describe the theory associated with the radius of an atom as it

- a. gains an electron
- b. loses an electron



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25. Would you expect the first ionisation enthalpies for two isotopes of the same element to be the same or different? Justify your answer.



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26. What are the major differences between metals and non-metals?



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27. Use the periodic table to answer the following questions.

a. Identify an element with five electrons in the outer subshell.

b. Identify an element that would tend to lose two electrons.

c. Identify an element that would tend to gain two electrons.

d. Identify the group having metal, non-metal, liquid as well as gas at the room temperature.



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28. The increasing order of reactivity among group 1 elements is $Li < Na < K < Rb < Cs$ whereas that among group 17 elements is $F > Cl > Br > I$. Explain.



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29. Write the general outer electronic configuration of s - , p - , d - and f - block elements.





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30. Assign the position of the element having outer electronic configuration

a. $ns^2 np^4$ for $n = 3$

b. $(n - 1)d^2 ns^2$ for $n = 4$ and

c. $(n - 2)f^7 (n - 1)d^1 ns^2$ for $n = 6$, in the periodic table.



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31. The first ($\Delta_i H_1$) and second ($\Delta_i H_2$) ionisation enthalpies (inkJmol^{-1}) and the ($\Delta_{eg} H^\ominus$) electron gain enthalpy (inkJmol^{-1}) of a few elements are given below:

Elements	($\Delta_i H_1$)	($\Delta_i H_2$)	$\Delta_{eg} H^\ominus$
<i>I</i>	520	7300	- 60
<i>II</i>	419	3051	- 48
<i>III</i>	1681	3374	- 328
<i>IV</i>	1008	1846	- 295
<i>V</i>	2372	5251	+ 48
<i>VI</i>	738	1451	- 40

Which of the above elements is likely to be

a. the least reactive element.

b. the most reactive metal.

c. the most reactive non-metal.

d. the least reactive non-metal.

e. the metal which can form a stable binary halide of the formula MX_2 (X=halogen).

f. the metal which can form a predominantly stable covalent halide of the formula MX (X=halogen).



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32. Predict the formula of the stable binary compounds that would be formed by the

combination of the following pairs of elements.

a. Lithium and oxygen

b. Magnesium and nitrogen

c. Aluminium and iodine

d. Silicon and oxygen

e. Phosphorus and fluorine

f. Element 71 and fluorine



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33. In the modern periodic table, the period indicates the value of

- (a) atomic number
- (b) atomic mass
- (c) principal quantum number
- (d) azimuthal quantum number.

A. atomic number

B. atomic mass

C. principal quantum number

D. azimuthal quantum number.

Answer:



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34. Which of the following statements related to the modern periodic table is incorrect?

a. The p -block has 6 columns, because a maximum of 6 electrons can occupy all the orbitals in a p -shell.

b. The d -blocks has 8 columns, because a maximum of 8 electrons can occupy all the orbitals in a d -subshell.

c. Each block contains a number of columns equal to the number of electrons that can occupy that subshell.

d. The block indicates value of azimuthal quantum number (l) for the last subshell that received electrons in building up the electronic configuration.

A. The p-block has 6 columns, because a maximum of 6 electrons can occupy all the orbitals in a p-shell.

B. The d-block has 8 columns, because a maximum of 8 electrons can occupy all the orbitals in a d-subshell.

C. Each block contains a number of columns equal to the number of electrons that can occupy that subshell.

D. The block indicates value of azimuthal quantum number (l) for the last subshell that received electrons in building up the electronic configuration.

Answer:



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35. Anything that influences the valence electrons will affect the chemistry of the element. Which one of the following factors does not affect the valence shell ?

A. Valence principal quantum number (n)

B. Nuclear charge (Z)

C. Nuclear mass

D. Number of core electrons.

Answer:



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36. The size of isoelectronic species F^{\ominus} , Ne , and Na^{\oplus} is affected by

A. nuclear charge (Z)

B. valence principal quantum number (n)

C. electron-electron interaction in the outer orbitals

D. none of the factors because their size is the same.

Answer:



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37. Which one of the following statements is incorrect in relation to ionisation enthalpy?

A. Ionization enthalpy increases for each successive electron.

B. The greatest increase in ionization enthalpy is experienced on removal of electron from core noble gas configuration.

C. End of valence electrons is marked by a big jump in ionization enthalpy.

D. Removal of electron from orbitals bearing lower n value is easier than from

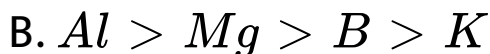
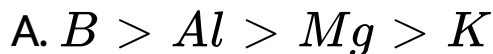
orbital having higher n value.

Answer:



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38. Considering the elements B , Al , Mg and K , the correct order of their metallic character is



C. $Mg > Al > K > B$

D. $K > Mg > Al > B$

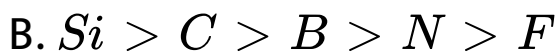
Answer:



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39. Considering the elements B, C, N, F and Si , the correct order of their non-metallic character is ?

A. $B > C > Si > N > F$

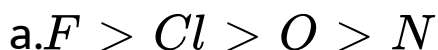


Answer:



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40. Considering the elements F, Cl, O and N , the correct order of their chemical reactivity in terms of oxidising property is



b. $F > O > Cl > N$

c. $Cl > F > O > N$

d. $O > F > N > Cl$

A. $F > Cl > O > N$

B. $F > O > Cl > N$

C. $Cl > F > O > N$

D. $O > F > N > Cl$

Answer:



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