



CHEMISTRY

BOOKS - PEARSON IIT JEE FOUNDATION

PERIODIC TABLE

Example

1. What are the basic differences between Mendeleev's periodic table and modern periodic table?



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2. In the modern periodic table, magnesium is surrounded by elements with atomic

numbers 4, 11, 13 and 20. Identify the elements. Which of these have

chemical

properties resembling magnesium?

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3. How was the problem of placement of isotopes in Mendeleev's periodic table overcome in modern periodic table?

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4. (a) Name two elements you would expect to show chemical reactions similar to sodium.

What is the basis of your choice?

(b) Arrange the elements present in that group in the increasing order of reactivity.

Give reason.

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5. Teacher explained periodicity of ionisation potential in a period and group with reasons. She then drew a curve of IP vs. atomic number for elements with $Z = 11$ to $Z = 20$. On the basis of the curve, she asked the following questions to students.

(a) Identify the elements occupying peaks and bottom-most points. (b) Also identify 'X', and 'Y' marked in the curve.

(c) In what respect 'X' and 'Y' deviate from their preceding elements?

When students answered these correctly, she was satisfied and told - "Now, I will give

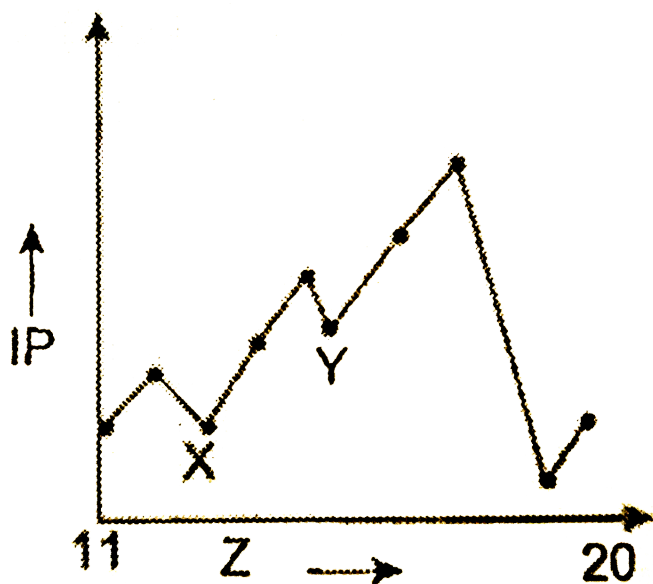
you a brain teaser to get me answer by next chemistry class" . Students enthusiastically

said - "yes"! Then teacher wrote the following question on board __

(d) " Why do "X" and "Y" show deviations from their preceding elements in the

trend of IP values"? What explanation would you give if you were there in

the class?



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6. Ionisation energy is the energy absorbed whereas electron affinity is the energy released. Explain.

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7.(a) One mole of atoms of an element 'X' absorb 800 kJ of energy for the formation

of unipositive ions. For the conversion of one mole of 'X' atoms into tripositive

ions, 6800 kJ of energy is required. Second and third ionisation energies are in

2 : 3 ratio. Calculate the second and third ionisation energies.

(b) First and second ionisation energies of $\text{Be}_{(g)}$ are 900 and 1750 kJ/mol, respectively.

Calculate approximate percentage of $\text{Be}_{(g)}^{2+}$ ions, if 1 g of $\text{Be}_{(g)}$ absorbs 150 kJ of energy (Be atomic weight is 9).

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8. The ionic size of Cl^- is greater than that of K^+ ion, though they are isoelectronic.

Explain.

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9. A sharp change in the atomic radius is observed from lithium to potassium but a gradual change in the atomic radius is observed from potassium to caesium. Explain.

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Very Short Answer Type Questions

1. Mendeleev arranged elements in the increasing order of their atomic masses.

True/False

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2. Why did Newland's law of octaves fail?

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3. Zero group elements are known as _____ gases.

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4. Why are the 's-' and 'p-' blocks elements called representative elements?

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5. General electronic configuration of s-block elements is _____.

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6. Describe the trend of oxidizing and reducing property along a period and a group of the periodic

table.

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7. Name the elements whose atomic weight was corrected by Mendeleev.

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8. Describe the trend of electron affinity along a period.

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9. Describe the trend of atomic size along a period and a group in the periodic table.

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10. Which periods are called the short periods and which are called the long periods? Why?

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11. describe the trend of ionisation potential along a period and a group in the periodic table.

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12. Why are the chemical properties of the elements belonging to the same group similar?

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13. An element, the atomic number with 36 belongs to _____ group and _____ period.

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14. What do you mean by representative elements?

Give an example.

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15. Which group contains the noble gases and what are the special characteristics of these gases?

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16. General electronic configuration of chalcogens is _____.

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17. Describe the trend of ionisation potential down the group in the periodic table.



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18. Describe how the metallic and non-metallic characters vary along a period and group the periodic table.



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19. The elements present in _____ and _____ periods can exhibit diagonal relationship.



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20. Ionisation potential value of Cs is equal to the electron affinity value of its corresponding _____.



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21. _____ block elements can exhibit variable number of oxidation states.

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22. What is a covalent radius?

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23. In the long form of periodic table _____ group contains the maximum number of elements.

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24. Anion size is always _____ than the parent atom.

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25. How does the electron affinity vary in the first transition series?

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26. In the f-block elements the last or differentiating electron enters the f-subshell of the

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27. _____ group elements are the strongest reducing agents.

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28. Define (a) metallic radius and (b) van der Waals radius.

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29. Mendeleev's Periodic Table

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Short Answer Type Questions

1. What was the Mendeleev's basis of the classification of elements.?

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2. Why are lanthanides and actinides place at the bottom of the periodic table?

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3. Describe how effective nuclear charge changes along a period and a group in a periodic table.

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4. Why are the values of the first, the second, the third ionisation energies different from each other?

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5. How does electron affinity vary in halogens?

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6. What are the basic differences between Mendeleev's periodic table and modern periodic table?

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7. Among all the periods, which one is incomplete and what are the main important properties exhibited by all the elements present in this period?

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8. What is the difference between electronegativity and electropositivity?

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9. What is the difference between transition and inner transition elements?

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10. How does filling of valence electrons takes place in p-block, d-block and f-block elements?

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Essay Type Questions

1. What are the merits and limitations of the long form of the periodic table?

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2. Describe briefly Mendeleev's periodic table along with its merits.

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3. What are the limitations of Mendeleev's periodic table?

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4. MODERN PERIODIC TABLE

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5. Explain briefly about the groups of the modern periodic table and also classify the elements depending on electron filling in s-, p-, d- and f-subshells along with the position in the periodic table.

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1. Modern Periodic Table

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2. in a period, the first element has the smallest size.

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3. s' and 'p' block elements except zero group are known as representative elements.

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4. The inert gas present in the second long period is

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5. Among the isoelectronic ions Na^+ , Mg^{2+} and Al^{3+} , Na^+ ion have the largest size.

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6. Alkali metals are strong reducing agents.

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7. Electronegativity is the property of an atom in a bonded molecule.

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8. In the periodic table, vertical columns of elements are called _____ and horizontal rows of elements are called _____.



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9. Assertion (A): First ionisation energy of beryllium is greater than that of boron.

Reason (R): Boron has larger size than beryllium.

- A. (a) Both A and R are true and R is the correct explanation of A
- B. (b) both A and R are true and R is not the correct explanation of A
- C. (c) A is true, R is false
- D. (d) A is false, R is true

Answer: b



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10. Which of the following properties is a periodic property?

- A. (a) colour
- B. (b) melting point
- C. (c) refractive index
- D. (d) atomic size

Answer: D

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11. Which one of the following electronic configurations corresponds to the most electropositive character?

- A. (a) $[He]2s^1$
- B. (b) $[Ne]3s^1$
- C. (c) $[Ar]4s^1$

D. (d) $[\text{Xe}]6s^1$

Answer: D

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12. The general electronic configuration of representative elements is

A. (a) $ns^{1-2}np^{1-6}$

B. (b) $ns^{1-2}np^{1-5}$

C. (c) $ns^{1-2}(n-1)p^{1-5}$

D. (d) $ns^{1-2}(n-1)p^{1-6}$

Answer: C

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13. Predict the formula of a compound formed between a metal 'M' that has 1st, 2nd, 3rd IP values as 518, 7314, 9820 kJ/mol , respectively and a halogen 'X'.

A. (a) MX_2

B. (b) M_2X_3

C. (c) MX_3

D. (d) MX

Answer: D



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14. In a period, from the left to right the electron affinity, increases, but alkaline earth metals have lower electron affinity than alkali metals because

- A. (a) alkaline earth metals have lesser atomic radius than alkali metals.
- B. (b) alkline earth have higher electronegativity than alkali metals.
- C. (c) alkaline earth metals have completely filled 's-' orbitals.
- D. (d) alkaline earth metals have lesser electronegativity than alkali metals.

Answer: C

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15. 5f series elements are known as

- A. (a) lanthanides
- B. (b) representative elements

C. (c) transition elements

D. (d) actinides

Answer: D



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16. The first ionisation energies of Li, Be, B and C are

in the order:

A. (a) $Li > Be < B < C$

B. (b) $Li < Be > B < C$

C. (c) $Li > Be > B > C$

D. (d) $Li < Be > B > C$

Answer: B



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17. Predict the powerful oxidizing agent in the 3rd period:

- A. (a) sulphur
- B. (b) sodium
- C. (c) chlorine
- D. (d) bromine

Answer: C



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18. an element with atomic number '32' belongs to

- A. (a) 4th period, VIA group
- B. (b) 3rd period, IVA group
- C. (c) 4th period, IVA group
- D. (d) 5th period, VA group

Answer: C

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19. The element having the electronic configuration $[Kr]4d^6(10)4f^{14}5s^25p^65d^26s^2$ belongs to

- A. (a) s-block
- B. (b) p-block
- C. (c) d-block
- D. (d) f-block

Answer: C

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20. The number of valence electrons that can be present in the second element of any period is

A. (a) 1

B. (b) 2

C. (c) 5

D. (d) 7

Answer: B

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21. Transition metals exhibit variable oxidation states. It is because of

A. (a) the smaller atomic radius

B. (b) the high screening effect

C. (c) the very less energy difference between $(n - 1)$

d-subshell and ns-subshell

D. (d) the high nuclear charge

Answer: C



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22. Arrange F , Cl , O , N in the decreasing order of electronegativity

A. (a) $O > F > Cl > N$

B. (b) $F > O > Cl > N$

C. (c) $F > N > O > Cl$

D. (d) $Cl > F > O > N$

Answer: B



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23. In the sixth period, the orbitals being filled are

A. (a) $6s, 6p, 5d, 5f$

B. (b) $6s, 6p, 6d, 6f$

C. (c) 6s, 5f, 6d, 6p

D. (d) 6s, 4f, 5d, 6p

Answer: D



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24. Which of the following sequence of explanation is appropriate for explaining the reason for the periodicity of reducing property in a period or group?

(1) Tendency to undergo oxidation decreases in a period and increases in a group

(2) In a period ionisation energy increases and in a group it decreases.

(3) In a period the atomic size decreases and in a group it increases.

(4) The elements present in the left side of the periodic table have strong reducing property.

A. (a) 3 2 1 4

B. (b) 3 4 2 1

C. (c) 4 3 1 2

D. (d) 4 2 1 3

Answer:

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25. Which of the following triads does not follow

Dobereiner's law of triads?

A. (a) Li, Na, K

B. (b) Ca, Sr, Ba

C. (c) Be, Mg, Ca

D. (d) Cu, Ag, Au

Answer:



26. X belongs to IA or 1st group and 5th period and Y succeeds X in the group. Z succeeds Y in the period. Arrange the following statements in the correct sequence in order to arrange X,Y and Z in the increasing order of their atomic sizes.

- (1) Effect of number of valence electrons and number of shells on the atomic size.
- (2) Identification of the elements X,Y and Z.
- (3) Determination of the number of shells and the number of valence electrons present in X, Y and Z.
- (4) Determination of the positions of Y and Z in the periodic table based on the position of X.

A. (a) 4 2 3 1

B. (b) 2 4 3 1

C. (c) 3 1 4

D. (d) 4 3 1

Answer:



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27. Which among the following is not an anomalous pair in Mendeleev's periodic table?

A. (a) Co, Ni

B. (b) Te, I

C. (c) Ar, K

D. (d) Sc, Ga

Answer:



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28. The energy released when an electron is added to the valence shell of a neutral, gaseous, isolated atom is called _____

- A. (a) electronegativity
- B. (b) ionisation potential
- C. (c) electron affinity
- D. (d) lattice energy

Answer:

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29. Which one of the following electronic configuration corresponds to the element with maximum electropositive character?

- A. (a) $[Kr]5s^1$

B. (b) $[Ne]3s^1$

C. (c) $[Ar]4s^1$

D. (d) $[Xe]6s^1$

Answer:

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30. Which of the following elements has maximum electronegativity?

A. (a) P

B. (b) S

C. (c) Al

D. (d) Si

Answer:

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31. Which of the following elements acts as the best reducing agent?

A. (a) Na

B. (b) Cl

C. (c) Mg

D. (d) F

Answer:

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32. The elements present in d-block are

A. (a) metals and non-metals

B. (b) only metals

C. (c) only non-metals

D. (d) metals, metalloids and non-metals

Answer:

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33. Total number of elements in 6th period are:

A. (a) 18

B. (b) 31

C. (c) 32

D. (d) 17

Answer:

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34. an element with atomic number '32' belongs to

A. (a) 4^{th} period, VIA group or 16^{th} group

B. (b) 3^{rd} period, IVA group or 14^{th} group

C. (c) 4^{th} period, IVA group or 14^{th} group

D. (d) 5^{th} period, VA group or 15^{th} group

Answer:

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35. The formulae of oxides formed when barium burns

in presence of oxygen are

A. (a) Ba_2O , BaO

B. (b) BaO , BaO_2

C. (c) BaO , Ba_2O_2

D. (d) Ba_2O , BaO_2

Answer:



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36. If the consecutive ionisation energies of an element

A are 496, 4564, 6918, 9542 kJ / mole respectively,

the formula of the oxide formed by A is

A. (a) A_2O_3

B. (b) AO

C. (c) AO_2

D. (d) A_2O

Answer:



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37. The numerical value of ionisation energy of a unipositive

ion is approximately equal to

- A. (a) IP value of neutral atom
- B. (b) EA value of neutral atom
- C. (c) IP value of dipositive ion
- D. (d) EA velue of dipositive ion

Answer:

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38. Which of the folloeing sets of atomic numbers corresponds to elements belonging to s-, d-, f-, p-blocks respectively?

- A. (a) 35, 37, 29, 70
- B. (b) 35, 29, 70, 37
- C. (c) 37, 29, 70, 35
- D. (d) 37, 29, 35, 70

Answer:

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Level 1 Fill In The Blanks

1. In the long form of the periodic table, _____ group elements can release maximum amount of energy by the addition of electron into its valence shell.

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2. The ascending order of the first ionisation potential of C, N, O and F is _____.

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3. The total number of inner transition elements present in the 7th period are _____.

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4. Amongst the species Br^- , Br , Br^+ , the smallest one in size is _____.

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5. In most of the lanthanides, the penultimate shell contains _____ electrons in _____ orbitals.

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6. Metals exhibit _____ oxidation states in their compounds.

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7. Match the entries in Column A with the appropriate ones in column B.

. Column A

- A. s-block
- B. Fluorine
- C. Chlorine
- D. d-block
- E. 4f-series
- F Helium
- G. Francium
- H. Noble gases

. Column B

- () a. Radioactive metal
- () b. Highest first IP value
- () c. Lanthanides
- () d. Highly reactive metals
- () e. Heavy metals
- () f. Always from -1 oxidation
- () g. Highest electron affinity
- () h. Xero group elements



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Level 2

1. Why is the atomic radius of oxygen slightly more than that of nitrogen?



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2. Predict the position of an element with atomic number 55 in the periodic table and explain the chemical behaviour of the element.

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3. Why is electron affinity of chlorine more than that of fluorine?

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4. Why do most of the inner transition elements exhibit stable +3 oxidation state?

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5. Xenon has an octet configuration in the valence shell but it shows variable valency with the highly electronegative elements like oxygen and fluorine.

Comment.

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6. Though oxygen and sulphur belong to the same group, sulphur shows many oxidation states, whereas oxygen does not show a higher oxidation state than that of -2.

Comment.

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7. First and second ionisation energies of $Be_{(g)}$ are 900kJmol^{-1} and 1750kJmol^{-1} approximately.

Calculate approximate percentage of Be^{2+} (g) ions, if

1 g of $Be_{(g)}$ absorbs 150 kJ of energy [atomic weight of Be is 9].

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8. The separation of one lanthanide from another is an extremely difficult task, almost as difficult as the separation of isotopes of one element. Justify.

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9. In a Particular transition series, the atomic radius reaches minimum up to group VIII elements, then again increases towards the end of the series. Give appropriate reasons.

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10. ionisation potential decreases down the group in representative elements while transition elements of the 6th period have greater ionisation potential values compared to the elements of the 5th period. Justify.

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11. The densities of transition metals are greater than the alkali and alkaline earth metals. Justify.

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12. Successive ionisation potentials of an element 'X' are $IP_1 = 520 \text{kJmol}^{-1}$, $IP^2 = 7,298 \text{kJmol}^{-1}$ and $IP^3 = 10,815 \text{kJmol}^{-1}$. Give the probable formulae of chloride and oxide of 'X'.

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13. An element 'A' has atomic number 28. What is the electronic configuration of the elements below it in the periodic table? Predict their chemical properties.

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Level 2 Application Based Questions

1. When a Dobereiner triad is considered, the sum of atomic weights of extreme elements X and Z is 177.6 and difference of Z and Y is five times the number of protons present in a neon atom. Identify X, Y and Z.

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2. Iron can form two types of ions. Compare the ionic sizes of the respective ions.

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3. Three elements A, B and C have atomic numbers as x , $x + 1$ and $x + 2$. The atomic size of C is greater than that of B but size of B is less than that of A. Predict the positions of A, B and C in the periodic table and justify the trend in atomic size.

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4. A teacher while explaining the definition of ionisation potential gave an example: Ionisation potential value of sodium is $140 \text{ kJ} / \text{mol}$. That means, 140 kJ of energy is required to remove

the lone electrons form '3s' orbitals of one mole of gaseous sodium atoms. Then, a student Rinku stood up immediately and asked: sodium is a solid metal. Why should we consider it in gaseous state? What explanation would have been given by the teacher?

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5. Formation of X^- ion from 'X' is associated with the release of 144 kJ/mol energy. However, Formation of X^{-2} ion from X^- is associated with the absorption of 840 kJ of energy. How do you account for this?

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6. A tripositive ion of element 'X' has six electrons with $l = 0$ and five electrons with $l = 2$.

(a) Predict the group and period to which 'X'

belongs.

(b) Dose the element show variable valencies? Justify.



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7. Identig the position of the elements having outer

electronic configuration:

(a) ns^2np^5 for $n = 3$

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



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8. The steady decrease in size of lanthanide elements

and their ions is called lanthanide contraction.

In lanthanide elements, the differentiating electron

enters into antepenultimate 'f' subshell.

(a) How does the entry of differentiating electron

into antepenultimate shell affect the atomic and ionic sizes?

Densities of 6th period elements are double to those of 5th period elements. Why?

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9. An element 'X' has three completely filled shells and forms a stable uninegative ion and the total number of electrons in the third and fourth shells is same. Identify the elements that form unipositive and dipositive ions that are isoelectronic with X^- ion. Compare the reactivities of these two elements with water. Give a reason in support of your answer.

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10. Why are the electron affinities of alkaline earth metals positive?



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Level 3

1. Generally transition elements form coloured compounds.

But Sc^{+3} forms colourless compounds. Justify.

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2. The first ionisation energy of magnesium is greater than that of sodium, whereas the reverse is true for second ionisation energy. Explain.

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3. Why do some of the periodic properties like atomic size, electronegativity and ionisation potential of transition and inner transition elements not show as much variation as the representative elements?

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4. Why are the electron affinities of IIA group and IIB group elements less than zero?

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5. The density of elements belonging to the 3rd transition series is double that of the elements belonging to the 2nd transition series provided they are

in the same group unlike alkali and alkaline earth metals. Comment.

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Level 3 Application Based Questions

1. In the d-block elements as we move along a period the atomic radius decreases in the beginning, reaches minimum and then increases towards the end of the series. Explain with appropriate reasons.

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2. Why are the values of electron affinity of the IIA group and IIB group elements less than zero?

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3. Why do some of the periodic properties like atomic size, electronegativity and ionisation potential of transition and inner transition elements do not show as much variation as the representative elements?

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4. Three elements X, Y and Z have atomic numbers 22, 40 and 72, respectively. Comment on the trend of change in ionisation potential values from X to Y and Y to Z.

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5. There is a sharp decrease in the ionisation energies from boron to aluminium but it is almost the same from aluminium to gallium. Justify.

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