CHEMISTRY

JEE (MAIN AND ADVANCED) CHEMISTRY

PERIODIC TABLE

Problems

1. What is called 'a chemical family'?

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2. What would be the name and symbol for the element to be discovered with atomic number 120?

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3. Give the longest group of the long form of the periodic table. How many elements are present in it?

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4. Why there is a break in the thirdperiod elements of the long form of the periodic table?

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5. Elements of group 10 is called pseudo-inert group. Comment.

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6. Is there any liquid transition element? If so name it?

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7. The element with $Z = 118$ is yet to be discovered. Predict its position in the long form of the periodic table.

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8. Compare the radii of H atom, H^+ ion and H^- ion.

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9. Why first ionisation potential of aluminium is less than that of magnesium?

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10. The ionisation enthalpy of sodium is 5.14 eV. How many k cal of energy is required to ionise all atoms

present in one gram of gaseous Na atoms?

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11.

$(A)F_2(g) + 2e^- \rightarrow 2F^-(g), (B)Cl_2(g) + 2e^- 2Cl^-(g)$

. Which of these processes is easy? Why?

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12. Write the descending order of electron affinity values of chalcogens.

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13. The successive ionisation enthalpies of an element M are $5.98, 18.82, 28.44, 119.96, 153.77, \ldots\ldots eV$ atom What is the formula of chloride of M?

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14. Bond energies of H_2, Cl_2 and HCl are respectively $104, 58 \text{ and } 103 \text{ k cal mol}^{-1}$. Calculate Pauling's electronegativity of chlorine.

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15. Write the minimum and maximum valencies of elements.

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16. The ionisation enthalpy of sulphur is $1014 \mathrm{kJ mol}^{-1}$. If its electronegativity is 2.4, what is its electron gain enthalpy?

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17. List out the properties of elements which increase in a group from top to bottom as well as in a period

from left to right.

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18. Using the periodic table , predict the formula of compound formed between element x group 13 and another element Y of group 16 .

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19. What is the valency and oxidation number of nitrogen in nitrogen pentoxide ?

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20. Which is a bigger ion among Na^+, F^-, O^{2-} and Mg^{2+}? Why?

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21. Zr is in 4d-series, Hf is in 5d-series. But their atomic radii is same. Why?

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22. Predict the metallic nature of the elements with atomic numbers 34, 35, 36 and 37.

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23. Is hydrogen electropositive?

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24. How does the electropositivity vary down the group of halogens?

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25. Name the elements of the second period

(a) which forms a strongly basic oxide and (b) which forms a strongly acidic oxide.

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26. Compar the acidic nature :

(a) H_2O and H_2O_2 and (b) Co and CO_2

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27. Are the oxidation state and covalency of Al in $\left[AICI(H_2O)_5\right]^{2+}$ same?

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28. Compare the oxidation ability of sulphur and chlorine.

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Exercise 2 1 1

1. What are antihistamines and antacids ? Give examples.

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2. Comment on Mendeleeff's periodic table.

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3. Write a note on 'Eka' elements present in the Mendeleeff's table.

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4. State and explain modern periodic law. What is its importance?

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5. How is the present modern periodic table constructed?

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Exercise 2 1 2

1. Write the salient features of the long form of the periodic table.

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2. Discuss the electronic configuration of elements along periods.

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3. How many periods arepresent in the periodic table? What are they called ?

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4. Write the general electronic configuration of the main group elements in the long form of the periodic table.

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5. Discuss the groupwise electronic configuration of elements.

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6. What are lanthanides and actinides? Where are they located in the long from of the periodic table?

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Exercise 2 1 3

1. Classify the elements into four blocks and discuss.

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2. Discuss the classification of aqueous solutions into three types.

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3. Write a note on p-block elements.

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4. Write a note on d-block elements.

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5. How do the representative elements exhibit chemical reactivity?

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6. Wtite the characteristic properties of transition elements.

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7. Give a brief account of inner transition elements.

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Exercise 2 1 4

1. What is periodicity? What is the cause for it?

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2. What are atomic and ionic radii? How do they vary in a period and in a group?

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3. Define and explain the terms: covalentradius, crystal radius and van der Waals radius with suitable examples.

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4. Define first and second ionisation potentials. Why second ionisation potential of an element is greater than the first ionisation potential?

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5. Discuss the factors influencing ionisation potential values of elements.

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6. What is electron affinity? Why the electron affinity of fluorine is less than that of chlorine?

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7. Define electronegativity. How is itcalculated based on Pauling's and Mulliken's scales?

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8. Write the important applications of electronegativity.

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9. What is valency? How is it related to the reference elements?

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10. Discuss the variation in the following properties in group IIA and third period:

(a) atomic radius, (b) ionisation potential and (c) electron affinity.

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11. How do the following vary along periods and groups?

(a) ionic radii, (b) electronegativity and (c) valency

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12. Discuss the variation of ionisation potentials of second period elements

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13. As the atomic number increases atomic size increases in a group, while it decreases in a period. Give reasons.

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14. Radius of cation is less than that of parental atom, but radius of anion is greater than that of parental atom. Explain.

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15. What is lanthanide contraction? Give one of its consequences.

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16. What is shielding effect? How does it effect ionisation potential values?

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17. Explain, the following:

(i) 'B' has less ionisation potential than ‘Be’.

(ii) 'N' has more ionisation potential than 'O'.

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18. What is the correct order of radii of Fe^{2+}, Fe^{3+} and neutral Fe atom. Why?

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19. Write the differences between electron affinity and electronegativity.

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20. Electron gain enthalpy of nitrogen and neon are very less in the second period. Why.

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Exercise 2 1 5

1. What is electropositivity? Discuss the metallic nature of elements.

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2. With suitable examples, classify the oxides based of their nature.

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3. Write the periodic changes in the following properties :

(a) nature of the oxides of elements and (b) metallic and non-metallic properties of elements.

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4. Write a note on diagonal relationship of elements.

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5. What is the similarity in the properties of beryllium and aluminium? Write the reasons for the similarity.

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Do You Know

1. Which is the lightest element?

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2. Which is the lightest metal?

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3. Which is the hardest element?

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4. Which is the most abundant element in the universe?

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5. Which is the most abundant element in the earth's crust?

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6. Which is the most abundant element in the earth's crust?

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7. Which isthe most abundant metal in the sea water?

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8. The most abundant element in the earth's atmosphere is

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9. Which is the most abundant inert gas element in air?

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10. Which is the simplest element?

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11. Which element isnamed after sun?

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12. Which element is normally formed in the radioactive decay?

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13. Which element is placed in two different groups of the long form of the periodic table?

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14. Which element has smallest atomic radius?

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15. Use the periodic table to predict which element has the largest atomic radius.

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16. Which one of the following elements has the highest first ionisation potential?

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17. Which element has highest second ionisation enthalpy?

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18. Which element possesses highest electron affinity?

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19. Which element has least electron affinity?

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20. Which element has least electronegativity in the Pauling's scale?

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21. Which element has least electronegativity in the Pauling's scale?

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22. Which element is the bestnon-metal?

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23. Which element is the best metal available?

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24. Which element is the best metalloid?

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25. Which is the liquid non-metal at room temperature ?

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26. Which is the liquid metal at room temperature?

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27. Which element has highest boiling point?

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28. Which element has least boiling point?

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29. Which element is most electropositive?

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30. Which element is least electropositive?

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31. Which element is the best oxidising agent?

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32. Which element is the best reducing agent in its vapour state?

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33. Which element is the best reducing agent in aqueous solution?

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34. Which element is common in all amalgams?

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35. Which element does not form amalgam and is used to store mercury?

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36. Which element forms highest stable oxidation state in its compounds?

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37. Which element forms least oxidation state in its compounds?

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38. Which element forms maximum number of types of oxidation states?

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39. Which element exhibits highest catenation ability?

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40. Which element exhibits highest number of allotropes?

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41. Which gaseous element exhibits allotropy?

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42. Which element has highest atomicity?

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43. Which element is heaviest naturally available in the earth's crust?

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44. Which is the lightest radioactive element?

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45. Which element represents largest stable atoms?

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46. Which element hasmaximum number of stable isotopes?

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47. Which element has least atomic volume?

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48. Which is the densest element?

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49. Which element is chemically most stable?

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50. Which element has no neutron ?

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51. Which is the first synthetic element ?

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52. Which is the end product element of all netural decay series?

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53. Which element is called white gold ?

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54. Which element is most poisonous

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Questions For Descriptive Answers

1. Write on the IUPAC nomenclature of the elements with atomic number greater than 103.

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2. What are the groups, periods and blocks of the elements with atomic numbers 35 and 56?

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3. How are the elements classified based on thedifferentating electron configuration?

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4. Knowing the electronic configuration of an element, its position in the periodic table and its properties can be easily understood. Justify.

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5. What is electronegativity? How is this useful in understanding the nature of elements?

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6. How does the position of element in the periodic table useful in finding valency and oxidation number?

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7. Write the important applications of electronegativity.

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8. What is electron gain enthalpy? On what factors does it depend?

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9. What is the role played by the inner electrons on the radius and ionisation potential values?:

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10. Write the differences between ionisation enthalpy and electron gain enthalpy.

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11. Write the increasing order of ionisation enthalpies of Be, B, C, N and O. Why the trend does not correspond to the atomic numbers?

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12. Which among the following should have a smaller second ionisation energy: Na or Mg? Why?

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13. How are bond energies useful for the calculation of electronegativity?

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14. Both ionisation enthalpy and electron gain enthalpy have some irregular trends in the third period. Explain.

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15. With reference to the periodic table, name the following :

(a) the halogen in the fifth period, (b) the non-metal having porperties similar to phosphorous and (c) the most reactive metal of third period.

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16. Mention different chemical criteria to call an element as metal.

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17. How do you account for the highly electro-positive nature of alkali metals ?

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18. What are anhydrides? Write exmples of acidic and basic anhydrides.

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19. Alkali metals are good reductants and halogens are good oxidants. Why?

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20. Comment on the following :

(a) vertical relationship of elements, (b) horizontal

relationship of elements and (c) diagonal relationship of elements.

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21. How many periods are needed to accommodate all elements up to Z value 112 ?

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22. How is polarisation power useful in explaining the diagonal relationship ?

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23. I_1 and I_2 of an element are 700 and 1200 kJmol$^-$ If 1000 kJ mol^{-1} energy is supplied to the gaseous atomic element and the ionisations occur in succession, find the ratio of monovalent and divalent cations.

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24. The energy required for the following process is $1.96 \times 104 \ \ \mathrm{kJ\ mol}^{-1} \rightarrow 3e^- + Li^{3+}(g)$ If the first ionisation energy of lithium is $520\ \mathrm{kJ\ mol}^{-1}$ what is the second ionisation energy?

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25. Compare the ionisation potentials of He and He^{+}. Account for the differences.

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26. Bond energies of H_2, F_2 and HF are respec tively 104.2, 36.6 and $134.6 kcal \text{mol}^{-1}$. If the electronegativity value of hydrogen is 2.1, calculate the electro-negativity value of fluorine.

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27. Ionisation enthalpy of chlorine is $13\,\mathrm{eV\ atom^{-1}}$ Electron gain enthalpy of chlorine is $-348\mathrm{kJmol^{-1}}$ and if this energy is used for the conversion of $Cl(g) \rightarrow Cl^{+}(g)$, how many ions can be obtained?

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28. Be forms Be^{2+} and Al^{3+} forms Al^{3+}. If the radii of Be^{2+} and Al^{3+} are respectively 31 and 53.5pm, show that their polarisation abilities are same.

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29. Among $F^-_{(g)}$, $Cl^{-0}_{(g)}$, $Br^-_{(g)}$ and $I^-_{(g)}$, which one requires the highest amount of energy to remove an electron. Why?

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30. Among $Li(g), Cs(g), Cl(g)$ and $Cl^-_{(g)}$ which one requires the least amount of energy to remove on electron. Why ?

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31. If we assumed that each orbital can accomidate three electrons, then chromium belongs to which block ?

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32. An element with the electronic configuration $[Xe]6s^2 4f^{14} 5d^1$ belong to which block in the modern periodic table.

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33. Calculate the IP_3 of lithium.

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34. $H-H$ and $Cl-Cl$ bond length are 0.74Å and 1.98Å What is the approximate bond length of HCl molecule.

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35. X and Y are two univalent elements. In order to form electrovalent compounds XY and YX, what would be their values of ionisation potentials, electron gain enthalpy and electro-negativity?

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36. Few transition elements show $+1$ oxidation state. Explain.

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37. The first $(D \leq taH)$ and second ionisation enthalipies (ΔH_2) in $kJmol^{-1}$ and the electron gain enthalpy (ΔHg) in $kJmol^{-1}$ of a few elements are given below:

Element	ΔH_1	ΔH_2	ΔH_{eg}
I	520	7300	-60
II	419	3051	-48
III	1681	3374	-328
IV	1008	1846	-295
V	2372	5251	+48
VI	738	1451	-40

Which element is likely

a) the least reactive element

c) the most reactive non-metal

b) the most reactive metal

d) the least reactive non-metal

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

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