# DPP - Daily Practice Problems

Name : _____ Date : _____

Start Time : _____ End Time : _____

# CHEMISTRY 05

**SYLLABUS :** Classification of Elements & Periodicity

**Max. Marks : 120** **Time : 60 min.**

**GENERAL INSTRUCTIONS**

- The Daily Practice Problem Sheet contains 30 MCQ's. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.
- You have to evaluate your Response Grids yourself with the help of solution booklet.
- Each correct answer will get you 4 marks and 1 mark shall be deduced for each incorrect answer. No mark will be given/ deducted if no bubble is filled. Keep a timer in front of you and stop immediately at the end of 60 min.
- The sheet follows a particular syllabus. Do not attempt the sheet before you have completed your preparation for that syllabus. Refer syllabus sheet in the starting of the book for the syllabus of all the DPP sheets.
- After completing the sheet check your answers with the solution booklet and complete the Result Grid. Finally spend time to analyse your performance and revise the areas which emerge out as weak in your evaluation.

**DIRECTIONS (Q.1-Q.21) : There are 21 multiple choice questions. Each question has 4 choices (a), (b), (c) and (d), out of which ONLY ONE choice is correct.**

**Q.1** The $IP_1$, $IP_2$, $IP_3$, $IP_4$ and $IP_5$ of an element are 7.1, 14.3, 34.5, 46.8, 162.2eV respectively. The element is likely to be

(a) Na (b) Si (c) F (d) Ca

**Q.2** Which of the following relation is correct?

(a) 2 I.P. – E.A. – E.N. = 0

(b) 2 I.P. – E.N. + E.A. = 0

(c) 2 E.N. – I.P. – E.A. = 0

(d) E.N. – I.P. – E.A. = 0

**Q.3** Pd has exceptional valence shell electronic configuration of $4d^{10}5s^0$. It is a member of -

(a) $5^{th}$ Period, Group 10 (b) $4^{th}$ Period, Group 12

(c) $6^{th}$ Period, Group 10 (d) $5^{th}$ Period, Group 14

**Q.4** The electronic configuration of an element is $1s^2$, $2s^22p^6$,$3s^23p^4$. The atomic number of the element present just below the above element in the periodic table is

(a) 36 (b) 34 (c) 33 (d) 32

**Q.5** Calculate the energy needed to convert three moles of sodium atoms in the gaseous state to sodium ions. The ionization energy of sodium is 495 kJ $mol^{-1}$–

(a) 1485 kJ (b) 495kJ

(c) 148.5 kJ (d) None

| RESPONSE GRID | 1. ⓐⓑⓒⓓ | 2. ⓐⓑⓒⓓ | 3. ⓐⓑⓒⓓ | 4. ⓐⓑⓒⓓ | 5. ⓐⓑⓒⓓ |
|---|---|---|---|---|---|

*Space for Rough Work*

**Q.6** The paramagnetic species among the following is - $Na^+, Zn^{2+}, Cu^+, Fe^{3+}$

(a) $Na^+$ (b) $Zn^{2+}$ (c) $Cu^+$ (d) $Fe^{3+}$

**Q.7** The correct decreasing order of atomic size among the following species is : Ar, $K^+$, $Cl^-$, $S^{2-}$, $Ca^{2+}$

(a) $Ca^{2+} > K^+ > Ar > Cl^- > S^{2-}$

(b) $K^+ > Ca^{2+} > Cl^- > Ar > S^{2-}$

(c) $S^{2-} > Cl^- > Ar > K^+ > Ca^{2+}$

(d) $S^{2-} > Ar > Cl^- > Ca^{2+} > K^+$

**Q.8** Which is correct in the following?

(a) Radius of Cl atom is 0.99 Å, while that of $Cl^+$ ion is 1.54 Å

(b) Radius of Cl atom is 0.99 Å, while that of Na atom is 1.54 Å

(c) Radius of Cl atom is 0.95 Å, while that of $Cl^-$ ion is 0.81 Å

(d) Radius of Na atom is 0.95 Å, while that of $Na^+$ ion is 1.54 Å

**Q.9** Which oxide of N is isoelectronic with $CO_2$?

(a) $NO_2$ (b) NO (c) $N_2O$ (d) $N_2O_3$

**Q.10** Ionization potential of Na would be numerically the same as-

(a) Electron affinity of $Na^+$

(b) Electronegativity of $Na^+$

(c) Electron affinity of He

(d) Ionization potential of Mg

**Q.11** What should be the atomic number of the next halogen if discovered in future ?

(a) 115 (b) 119 (c) 117 (d) 121

**Q.12** The electronic configurations for some neutral atoms are given below : Which of these is expected to have the highest second ionization enthalpy?

(a) $1s^2, 2s^2 2p^6, 3s^2$ (b) $1s^2, 2s^2 2p^6, 3s^1$

(c) $1s^2, 2s^2 2p^6, 3s^2 3p^2$ (d) $1s^2, 2s^2 2p^6, 3s^2 3p^3$

**Q.13** The law of triads is applicable to-

(a) C, N, O (b) H, O, N

(c) Na, K, Rb (d) Cl, Br, I

**Q.14** The law of triads is not applicable on -

(a) Cl, Br, I (b) Na, K, Rb

(c) S, Se, Te (d) Ca, Sr, Ba

**Q.15** A given compound $A_2$ whose total $d_{A-A}$ is 1.4 Å . The atomic (covalent) radius of an atom A is –

(a) 0.7 Å (b) 0.5 Å

(c) 0.2 Å (d) 0.1 Å

**Q.16** In compound AB, electronegativity difference between A and B is 1.9. Atomic radius of A and B are 4 and 2 Å respectively. The distance between A & B means $d_{A-B}$ is–

(a) 6.72 Å (b) 5.82 Å

(c) 6.9 Å (d) 7.5 Å

**Q.17** I.E. of one H atom is $2.18 \times 10^{-18}$ J. The I.E. of H atom in kJ $mole^{-1}$ is -

(a) 1505 kJ $mole^{-1}$ (b) 1310 kJ $mole^{-1}$

(c) 1608 kJ $mole^{-1}$ (d) None

**Q.18** Among the elements Ca, Mg, P and Cl, the order of increasing atomic radii is :

(a) Ca < Mg < P < Cl (b) Mg < Ca < Cl < P

(c) Cl < P < Mg < Ca (d) P < Cl < Ca < Mg

**Q.19** Which of the following order is correct for acidic property?

(a) $SiH_4 > PH_3 > H_2S$ (b) $SiH_4 = PH_3 = H_2S$

(c) $SiH_4 < PH_3 > H_2S$ (d) $SiH_4 < PH_3 < H_2S$

**Q.20** The ionic radius of Cr is minimum in which of the following compounds ?

(a) $CrF_3$ (b) $CrCl_3$

(c) $Cr_2O_3$ (d) $K_2CrO_4$

| RESPONSE GRID | | | | | |
|---|---|---|---|---|---|
| | 6. (a)(b)(c)(d) | 7. (a)(b)(c)(d) | 8. (a)(b)(c)(d) | 9. (a)(b)(c)(d) | 10. (a)(b)(c)(d) |
| | 11. (a)(b)(c)(d) | 12. (a)(b)(c)(d) | 13. (a)(b)(c)(d) | 14. (a)(b)(c)(d) | 15. (a)(b)(c)(d) |
| | 16. (a)(b)(c)(d) | 17. (a)(b)(c)(d) | 18. (a)(b)(c)(d) | 19. (a)(b)(c)(d) | 20. (a)(b)(c)(d) |

*Space for Rough Work*

**Q.21** Arrange $Ce^{3+}$, $La^{3+}$, $Pm^{3}$ and $Yb^{3+}$ in increasing order of their size -

(a) $Yb^{3+} < Pm^{3+} < Ce^{3+} < La^{3+}$

(b) $Ce^{3+} < Yb^{3+} < Pm^{3+} < La^{3+}$

(c) $Yb^{3+} < Pm^{3+} < La^{3+} < Ce^{3+}$

(d) $Pm^{3+} < La^{3+} < Ce^{3+} < Yb^{3+}$

**DIRECTIONS (Q.22-Q.24) : In the following questions, more than one of the answers given are correct. Select the correct answers and mark it according to the following codes:**

**Codes :**

**(a)** 1, 2 and 3 are correct **(b)** 1 and 2 are correct

**(c)** 2 and 4 are correct **(d)** 1 and 3 are correct

**Q.22** Choose the correct statements –

(1) Element with lowest electronegativity is Cs

(2) Element with highest electronegativity is F

(3) Element with highest ionisation potential is He

(4) Element with lowest ionisation potential is Hg

**Q.23** Choose the correct statements corresponding to modern periodic table –

(1) No. of gaseous elements is 11

(2) No. of liquid elements is 6

(3) Number of solid elements is 95 (if discovered elements are 105)

(4) 3rd Period contains maximum number of gaseous elements.

**Q.24** Choose the correct order of atomic radius –

(1) Li > Be > B > C > N > O > F

(2) Li < Na < K < Rb < Cs

(3) $Mn > Mn^{+2} > Mn^{+3} > Mn^{+4}$

(4) $O > O^{-} > O^{-2}$

**DIRECTIONS (Q.25-Q.27) : Read the passage given below and answer the questions that follows :**

The tendency of an atom to attract shared pair of electrons towards itself is called electronegativity. EN and EA both have tendency to attract electrons but electron affinity is for isolated atoms, whereas electronegativity is for bonded atoms.

A polar covalent or ionic bond of A – B may be broken

as (a) $A-B \longrightarrow A^{-} : + B^{+}$ (EN A > EN B)

or (b) $A-B \longrightarrow A^{+} + :B^{-}$ (EN A < EN B)

depending on their tendency to attract bonded electron.

There is no unit of electronegativity as EN is tendency of a bonded atom not an energy

**Q.25** Give the correct order of electronegativity of the central atom in following compounds-

$CH_3-CH_3$, $CH_2=CH_2$, $CH\equiv CH$

(i) (ii) (iii)

The correct order is –

(a) i > ii > iii (b) iii > i > ii

(c) iii > ii > i (d) ii > iii > i

**Q.26** Which of the following compound has highest value of bond length?

(a) CsF (b) CsBr

(c) CsI (d) CsCl

**Q.27** The electronegativities of F and H are 4.0 and 2.1 respectively. The percent ionic character in H and F bond is-

(a) 43 (b) 34

(c) 94 (d) 39

| RESPONSE GRID | | | | | |
|---|---|---|---|---|---|
| | 21. ⓐⓑⓒⓓ | 22. ⓐⓑⓒⓓ | 23. ⓐⓑⓒⓓ | 24. ⓐⓑⓒⓓ | 25. ⓐⓑⓒⓓ |
| | 26. ⓐⓑⓒⓓ | 27. ⓐⓑⓒⓓ | | | |

*Space for Rough Work*

**DIRECTIONS (Q.28-Q.30) : Each of these questions contains two statements: Statement-1 (Assertion) and Statement-2 (Reason). Each of these questions has four alternative choices, only one of which is the correct answer. You have to select the correct choice.**

(a) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.

(b) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.

(c) Statement -1 is False, Statement-2 is True.

(d) Statement -1 is True, Statement-2 is False.

28. **Statement-1 :** First ionization energy for nitrogen is lower than oxygen.
**Statement-2 :** Across a period effective nuclear charge decreases.

29. **Statement-1:** The atomic radii of calcium is smaller than sodium.
**Statement-2:** Calcium has a lower nuclear charge than sodium

30. **Statement-1:** Noble gases have no electron affinity.
**Statement-2:** High electron affinity shows that the electron is loosely bonded to the atom.

| RESPONSE GRID | 28.ⓐⓑⓒⓓ | 29.ⓐⓑⓒⓓ | 30.ⓐⓑⓒⓓ |
|---|---|---|---|

| DAILY PRACTICE PROBLEM SHEET 5 - CHEMISTRY | | | |
|---|---|---|---|
| Total Questions | 30 | Total Marks | 120 |
| Attempted | | Correct | |
| Incorrect | | Net Score | |
| Cut-off Score | 40 | Qualifying Score | 60 |
| Success Gap = Net Score – Qualifying Score | | | |
| Net Score = (Correct × 4) – (Incorrect × 1) | | | |

*Space for Rough Work*

# DAILY PRACTICE PROBLEMS

# CHEMISTRY SOLUTIONS

# 05

**(1) (b)** The jump in IP value exists in $IP_5$ and thus removal of fifth electron occurs from inner shell. Thus element contains four electrons in its valency shell.

**(2) (c)** Where E.N. stands for electronegativity, E.A. stands for electron affinity and I.P. stands for ionization potential.

It is observed that for an element, E.A., E.N. and I.P. usually vary in the same direction. Hence when E.A. and E.N. increase the I.P. also increases E.N. has the mean value of I.P. and E.A.

$$E.N. = \frac{I.P. + E.A.}{2}$$

$\therefore$ 2E.N. = I.P. + E.A. or 2E.N. – I.P. – E.A. = 0

**(3) (a)** $4d^{10}5s^0$ is the exceptional configuration of Pd. Its electronic configuration should be $[_{36}Kr]4d^8, 5s^2$. Thus its Period = 5th

Group = ns + (n – 1)d electrons = 2 + 8 = 10

**(4) (b)** At. No. = 16 (S)

Next element below this element has atomic number = 16 + 18 = 34

**(5) (a)** Energy needed to convert 1 mole of sodium (g) to sodium ions = 495 kJ

$\therefore$ Energy needed to convert 3 moles of Na (g) to $Na^+$ ions = 495 × 3 = 1485 kJ

**(6) (d)** Paramagnetic species have at least one unpaired electron. Write the electronic configuration and observe the unpaired electron(s).

$Na^+(11)$ : $1s^2, 2s^2, 2p^6$ – all paired :

$Zn^{2+}(30)$; $1s^2, 2s^22p^6, 3s^23p^63d^{10}$ – All paired

$Cu^+(29)$ : $1s^2, 2s^22s^6, 3s^23p^63d^{10}$ – All paired

$Fe^{3+}(26)$ : $1s^2, 2s^2, 2p^6, 3s^23p^63d^5$ – 5 Unpaired electrons

**(7) (c)** In isoelectronic ions, the atomic size decreases as z/e ratio increases.

$$S^{2-}\ \frac{z}{e} = \frac{16}{18};\ Cl^-\ \frac{z}{e} = \frac{17}{18};\ Ar\ \frac{z}{e} = \frac{18}{18};$$

$$K^+\ \frac{z}{e} = \frac{19}{18};\ Ca^{2+}\ \frac{z}{e} = \frac{20}{18}$$

**(8) (b)** The atomic radius decreases along the period. Also cations are always smaller than their parent atoms and anions are always larger than their parent atom.

**(9) (c)** $N_2O$ (Z = 16) is isoelectronic with $CO_2$ (Z = 16).

**(10) (a)** $Na \rightarrow Na^+ + e$; IE of Na = +ve

$Na^+ + e^- \rightarrow Na$; E.A. of Na = –ve

Both are equal but opposite in nature.

**(11) (c)** The next halogen will have $7s^27p^5$ outer configuration. Since, the filling of 7p-orbitals will begin after 5f and 6d-orbitals, the atomic number of the new halogen will be 112 (up to the filling of 6d-orbitals) plus 5, i.e., 117.

**(12) (b)** The atom b, after losing outermost electron, acquires noble gas configuration (stable configuration). It is difficult to remove the next electron from ($1s^2, 2s^2 2p^6$) ion.

**(13) (d)** The law of triads is applicable to Cl, Br, I.

**(14) (b)** The law of triads is not applicable on Na, K, Rb.

**(15) (a)** $r_A = \frac{d_{A-A}}{2} = 1.4/2 = 0.7$ Å

**(16) (b)** Given $r_A = 4$ Å, $r_B = 2$ Å, $\Delta x = 1.9$

By the formula $d_{A-B} = r_A + r_B - 0.09\,(\Delta x)$

$= 4 + 2 - 0.09 \times 1.9 = 6 - 0.171 = 5.82$ Å

**(17) (b)** $I.E. = \frac{2.18 \times 10^{-18}\ J}{1 atom} \times \frac{6.02 \times 10^{23}\ atom}{mole}$

$= 1.31 \times 10^6\ J\ mole^{-1} = 1310\ kJ\ mole^{-1}$.

**(18) (c)**

| $_{12}Mg$ | $_{15}P$ | $_{17}Cl$ | $_{20}Ca$ |
|---|---|---|---|
| 160 | 110 | 99 | 197(pm) |

Cl < P < Mg < Ca

**(19) (d)** The acidic character of hydrides increases in a period for non-metals.

**(20) (d)** Cr has maximum oxidation number (+6) in $K_2CrO_4$ and thus has minimum ionic radius.

**(21) (a)** Lanthanide contraction is observed in these ions, i.e., ionic radius decreases as atomic number increases.

**(22) (a)**

(1) Element with lowest electronegativity is Cs.

(2) Element with highest electronegativity is F

(3) Element with highest ionisation potential is He

(4) Element with lowest ionisation potential is Cs

**(23) (b)**

(1) Number of gaseous elements - 11 (H, N, O, F, Cl + Noble gases)

(2) Number of liquid elements - 6 (Cs, Fr, Ga, Hg, Br and Uub)

(3) Bromine is the only non-metal which exists in liquid form.

Number of solid elements

- 89 (if discovered elements are 105)

- 95 (if discovered elements are 112)

(4) 2nd period contains maximum number (four) of gaseous elements. They are N, O, F and Ne.

**(24)** **(a)** Factors affecting atomic size are :

(1) $\text{Atomic radius} \propto \frac{1}{\text{Effective nuclear charge}}$

$Li > Be > B > C > N > O > F$

(2) Atomic radius $\propto$ No. of shells

$Li < Na < K < Rb < Cs$

(3) $\text{Atomic size} \propto \frac{1}{\text{Magnitude of +ve charge}}$

$Mn > Mn^{+2} > Mn^{+3} > Mn^{+4}$

(4) Atomic size $\propto$ Magnitude of $-$ve charge

Thus the correct order is.

$O > O^{-} > O^{-2}$

**(25)** **(c)** % s- characters

in $CH_3 - CH_3 = sp^3 = 25\%$

in $CH_2 = CH_2 = sp^2 = 33.33\%$

in $CH \equiv CH = sp = 50\%$

Hence decreasing order of electronegativity will be

$CH \equiv CH > CH_2 = CH_2 > CH_3 - CH_3$

**(26)** **(c)** Difference in electronegativities of the two concerned atoms is minimum in Cs—I, hence the bond length in Cs—I is maximum.

**(27)** **(a)** According to Hannay and Smith equation

% ionic character $= 16(x_A - x_B) + 3.5(x_A - x_B)^2$

% ionic character $= 16(4.0 - 2.1) + 3.5(4.0 - 2.1)^2$

$= 43$

**(28)** **(c)** In a period the value of ionisation potential increases from left to right with breaks where the atoms have somewhat stable configuration. In this case N has half filled stable orbital, hence it has higher ionisation energy.

**(29)** **(d)** Calcium has a higher nuclear charge than sodium.

**(30)** **(d)** All noble gases have stable configuration. Therefore, they can not take any electron which means that they have no affinity for electrons. High electron affinity shows that electron is strongly bonded to the atom.