# DPP - Daily Practice Problems

**Date :** | **Start Time :** | **End Time :**

# CHEMISTRY CC03

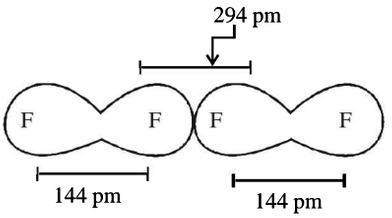
**SYLLABUS :** Classification of Elements and Periodicity in Properties

**Max. Marks : 120** **Marking Scheme :** + 4 for correct & (–1) for incorrect **Time : 60 min.**

INSTRUCTIONS : This 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.

**1.** The correct sequence which shows decreasing order of the ionic radii of the elements is
(a) $Al^{3+} > Mg^{2+} > Na^{+} > F^{-} > O^{2-}$
(b) $Na^{+} > Mg^{2+} > Al^{3+} > O^{2-} > F^{-}$
(c) $Na^{+} > F^{-} > Mg^{2+} > O^{2-} > Al^{3+}$
(d) $O^{2-} > F^{-} > Na^{+} > Mg^{2+} > Al^{3+}$

**2.** The van der Waal and covalent radii of fluorine atom respectively from the following figure are.




(a) 219pm, 72pm (b) 75pm, 72pm
(c) 147pm, 72pm (d) 147pm, 144pm

**3.** Arrange the following in increasing order of ionic radii?
$C^{4-}, N^{3-}, F^{-}, O^{2-}$
(a) $C^{4-} < N^{3-} < O^{2-} < F^{-}$
(b) $N^{3-} < C^{4-} < O^{2-} < F^{-}$
(c) $F^{-} < O^{2-} < N^{3-} < C^{4-}$
(d) $O^{2-} < F^{-} < N^{3-} < C^{4-}$

**4.** Which is not the correct order for the stated property.
(a) Ba > Sr > Mg ; atomic radius
(b) F > O > N ; first ionization enthalpy
(c) Cl > F > I ; electron affinity
(d) O > Se > Te ; electronegativity

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

5. In which of the following arrangements, the order is NOT according to the property indicated against it?
   (a) $Li < Na < K < Rb$ :
   Increasing metallic radius
   (b) $I < Br < F < Cl$ :
   Increasing electron gain enthalpy
   (with negative sign)
   (c) $B < C < N < O$
   Increasing first ionization enthalpy
   (d) $Al^{3+} < Mg^{2+} < Na^{+} < F^{-}$
   Increasing ionic size

6. The symbol and IUPAC name for the element with atomic number 120, respectively are
   (a) Ubn and unbinilium
   (b) Ubn and unbiunium
   (c) Ubn and unnibium
   (d) Ubn and unnilium

7. Sequence of acidic character is
   (a) $N_2O_5 > SO_2 > CO > CO_2$
   (b) $N_2O_5 > SO_2 > CO_2 > CO$
   (c) $SO_2 > CO_2 > CO > N_2O_5$
   (d) $SO_2 > N_2O_5 > CO > CO_2$

8. The correct order of ionization energy for carbon, nitrogen and oxygen atoms is:
   (a) $C > N > O$ (b) $C > N < O$
   (c) $C < N > O$ (d) $C < N < O$

9. Which of the following order is wrong?
   (a) $NH_3 < PH_3 < AsH_3$ – Acidic
   (b) $Li < Be < B < C$ – First IP
   (c) $Al_2O_3 < MgO < Na_2O < K_2O$ – Basic
   (d) $Li^{+} < Na^{+} < K^{+} < Cs^{+}$ – Ionic radius

10. The radii of F, $F^{-}$, O and $O^{2-}$ are in the order
   (a) $O^{2-} > F^{-} > F > O$
   (b) $F^{-} > O^{2-} > F > O$
   (c) $O^{2-} > O > F^{-} > F$
   (d) $O^{2-} > F^{-} > O > F$

11. Which of the following has the maximum number of unpaired electrons?
   (a) $Mg^{2+}$
   (b) $Ti^{3+}$
   (c) $V^{3+}$
   (d) $Fe^{2+}$

12. The incorrect statement among the following is
   (a) The first ionization potential of Al is less than the first ionization potential of Mg
   (b) The second ionization potential of Mg is greater than the second ionization potential of Na
   (c) The first ionization potential of Na is less than the first ionization potential of Mg
   (d) The third ionization potential of Mg is greater than the third ionization potential of Al.

13. According to the Periodic Law of elements, the variation in properties of elements is related to their
   (a) nuclear masses
   (b) atomic numbers
   (c) nuclear neutron-proton number ratios
   (d) atomic masses

14. Identify the correct order of the size of the following:
   (a) $Ca^{2+} < K^{+} < Ar < Cl^{-} < S^{2-}$
   (b) $Ar < Ca^{2+} < K^{+} < Cl^{-} < S^{2-}$
   (c) $Ca^{2+} < Ar < K^{+} < Cl^{-} < S^{2-}$
   (d) $Ca^{2+} < K^{+} < Ar < S^{2-} < Cl^{-}$

| RESPONSE GRID | | | | | |
|---|---|---|---|---|---|
| | 5. ⓐⓑⓒⓓ | 6. ⓐⓑⓒⓓ | 7. ⓐⓑⓒⓓ | 8. ⓐⓑⓒⓓ | 9. ⓐⓑⓒⓓ |
| | 10. ⓐⓑⓒⓓ | 11. ⓐⓑⓒⓓ | 12. ⓐⓑⓒⓓ | 13. ⓐⓑⓒⓓ | 14. ⓐⓑⓒⓓ |

**15.** Following statements regarding the periodic trends of chemical reactivity of the alkali metals and the halogens are given. Which of these statements gives the correct picture?

(a) Chemical reactivity increases with increase in atomic number down the group in both the alkali metals and halogens

(b) In alkali metals the reactivity increases but in the halogens it decreases with increase in atomic number down the group

(c) The reactivity decreases in the alkali metals but increases in the halogens with increase in atomic number down the group

(d) In both the alkali metals and the halogens the chemical reactivity decreases with increase in atomic number down the group

**16.** In which of the following arrangements, the sequence is *not* strictly according to the property written against it?

(a) HF < HCl < HBr , HI : increasing acid strength

(b) $NH_3 < PH_3 < AsH_3 < SbH_3$ : increasing basic strength

(c) B < C < O < N : increasing first ionization enthalpy

(d) $CO_2 < SiO_2 < SnO_2 < PbO_2$ : increasing oxidising power

**17.** Which of the following order is wrong?

(a) $NH_3 < PH_3 < AsH_3$ — Acidic

(b) Li < Be < B < C — $IE_1$

(c) $Al_2O_3 < MgO < Na_2O < K_2O$ — Basic

(d) $Li^+ < Na^+ < K^+ < Cs^+$ — Ionic radius

**18.** The correct order of electron gain enthalpy with negative sign of F, Cl, Br and I, having atomic number 9, 17, 35 and 53 respectively, is :

(a) F > Cl > Br > I (b) Cl > F > Br > I

(c) Br > Cl > I > F (d) I > Br > Cl > F

**19.** Which one of the following has largest ionic radius?

(a) $Li^+$ (b) $O_2^{2-}$

(c) $B^{3+}$ (d) $F^-$

**20.** Which one of the following arrangements represents the correct order of least negative to most negative electron gain enthalpy for C, Ca, Al, F and O?

(a) Ca < Al < C < O < F

(b) Al < Ca < O < C < F

(c) Al < O < C < Ca < F

(d) C < F < O < Al < Ca

**21.** Which of the following elements represents highly electropositive as well as highly electronegative character in its period?

(a) Hydrogen (b) Nitrogen

(c) Fluorine (d) None of these

**22.** Which one of the following ions has the highest value of ionic radius ?

(a) $O^{2-}$ (b) $B^{3+}$

(c) $Li^+$ (d) $F^-$

**23.** Among $Al_2O_3$, $SiO_2$, $P_2O_3$ and $SO_2$ the correct order of acid strength is

(a) $Al_2O_3 < SiO_2 < SO_2 < P_2O_3$

(b) $SiO_2 < SO_2 < Al_2O_3 < P_2O_3$

(c) $SO_2 < P_2O_3 < SiO_2 < Al_2O_3$

(d) $Al_2O_3 < SiO_2 < P_2O_3 < SO_2$

**24.** Which of the following arrangements represents the increasing order (smallest to largest) of ionic radii of the given species $O^{2-}$, $S^{2-}$, $N^{3-}$, $P^{3-}$?

(a) $O^{2-} < N^{3-} < S^{2-} < P^{3-}$ (b) $O^{2-} < P^{3-} < N^{3-} < S^{2-}$

(c) $N^3 < O^{2-} < P^{3-} < S^{2-}$ (d) $N^{3-} < S^{2-} < O^{2-} < P^{3-}$

| RESPONSE GRID | | | | | |
|---|---|---|---|---|---|
| | **15.** ⓐⓑⓒⓓ | **16.** ⓐⓑⓒⓓ | **17.** ⓐⓑⓒⓓ | **18.** ⓐⓑⓒⓓ | **19.** ⓐⓑⓒⓓ |
| | **20.** ⓐⓑⓒⓓ | **21.** ⓐⓑⓒⓓ | **22.** ⓐⓑⓒⓓ | **23.** ⓐⓑⓒⓓ | **24.** ⓐⓑⓒⓓ |

**25.** Which of the following oxides is amphoteric in character?

(a) $SnO_2$ (b) $SiO_2$

(c) $CO_2$ (d) CaO

**26.** The formation of the oxide ion $O^{2-}(g)$, from oxygen atom requires first an exothermic and then an endothermic step as shown below :

$O(g) + e^- \rightarrow O^-(g)$; $\Delta_f H^{\ominus} = -141$ kJ mol$^{-1}$

$O^-(g) + e^- \rightarrow O^{2-}(g)$; $\Delta_f H^{\ominus} = +780$ kJ mol$^{-1}$

Thus process of formation of $O^{2-}$ in gas phase is unfavourable even though $O^{2-}$ is isoelectronic with neon. It is due to the fact that

(a) Electron repulsion outweighs the stability gained by achieving noble gas configuration

(b) $O^-$ ion has comparatively smaller size than oxygen atom

(c) Oxygen is more electronegative

(d) Addition of electron in oxygen results in larger size of the ion.

**27.** Which of the following statements is wrong ?

(a) van der Waal's radius of iodine is more than its covalent radius

(b) All isoelectronic ions belong to same period of the periodic table

(c) I.E.$_1$ of N is higher than that of O while I.E.$_2$ of O is higher than that of N

(d) The electron gain enthalpy of N is almost zero while that of P is 74.3 kJ mol$^{-1}$

**28.** The first ($\Delta_i H_1$) and second ($\Delta_i H_2$) ionization enthalpies (in kJ mol$^{-1}$) and the electron gain enthalpy ($\Delta_{eg} H$) (in kJ mol$^{-1}$) of the elements I, II, III, IV and V are given below

| Element | $\Delta_i H_1$ | $\Delta_i H_2$ | $\Delta_{eg} H$ |
|---|---|---|---|
| I | 520 | 7300 | –60 |
| II | 419 | 3051 | –48 |
| III | 1681 | 3374 | –328 |
| IV | 1008 | 1846 | –295 |
| V | 2372 | 5251 | +48 |

The most reactive metal and the least reactive non-metal of these are respectively

(a) I and V (b) V and II

(c) II and V (d) IV and V

**29.** Consider the following statements:

(i) Atomic radii decreases across a row of the periodic table when we move from left to right.

(ii) Atomic radii increases down the column as we move from top to bottom.

(iii) Although the order of elements is based on atomic numbers, vertical families share similar chemical properties.

Which of the statement(s) given above is/are correct?

(a) (i) and (ii) (b) (i) and (iii)

(c) (ii) and (iii) (d) (i), (ii) and (iii)

**30.** Match Column-I with Column-II and select the correct answer by the given codes.

| Columnn-I (Atoms) | Column-II (Properties) |
|---|---|
| (A) He | (p) High electronegative |
| (B) F | (q) Most electropositive |
| (C) Rb | (r) Strongest reducing agent |
| (D) Li | (s) Highest ionisation energy |

(a) A – (s), B – (q), C – (r), D – (p)

(b) A – (p), B – (s), C – (q), D – (r)

(c) A – (s), B – (p), C – (r), D – (q)

(d) A – (s), B – (p), C – (q), D – (r)

| RESPONSE GRID | 25. ⓐⓑⓒⓓ | 26. ⓐⓑⓒⓓ | 27. ⓐⓑⓒⓓ | 28. ⓐⓑⓒⓓ | 29. ⓐⓑⓒⓓ |
|---|---|---|---|---|---|
| | 30. ⓐⓑⓒⓓ | | | | |

| DAILY PRACTICE PROBLEM DPP CHAPTERWISE 3 - CHEMISTRY | | | |
|---|---|---|---|
| Total Questions | 30 | Total Marks | 120 |
| Attempted | | Correct | |
| Incorrect | | Net Score | |
| Cut-off Score | 38 | Qualifying Score | 55 |
| Success Gap = Net Score – Qualifying Score | | | |
| Net Score = (Correct × 4) – (Incorrect × 1) | | | |

**1.** **(d)** All the given species contains 10 $e^-$ each i.e. isoelectronic.
For isoelectronic species anion having high negative charge is largest in size and the cation having high positive charge is smallest.

**2.** **(c)** Covalent radius is radius of an atom in its bound state i.e., in fluorine it is half of distance between two covalently bonded fluorine atoms; van der Waal radii is one-half of the distance between the nuclei of two identical non-bonded isolated atoms. These atoms are attracted toward each other through weak van der Waal's force hence van der Waal radii are very large.

**3.** **(c)** All the given species are isoelectronic. In case of isoelectronic species ionic radii increases with increase in negative charge on anions.

**4.** **(b)** On moving along the period, ionization enthalpy increases.
In second period, the order of ionization enthalpy should be as follows :
F > O > N.
But N has half-filled structure, therefore, it is more stable than O. That is why its ionization enthalpy is higher than O. Thus, the correct order of IE is
F > N > O.

**5.** **(c)** In a period the value of ionisation potential increases from left to right with breaks where the atoms have some what stable configuration. In this case N has half filled stable orbitals. Hence has highest ionisation energy. Thus the correct order is
B < C < O < N
and not as given in option (c)

**6.** **(a)** Atomic number (Z) = 120
IUPAC name = Unbinilium
Symbol = Ubn

**7.** **(b)** The acidic character of non metal oxides increases across a period from left to right and decreases down a group. So, acidic character will follow the order:
oxide of nitrogen > oxides of sulfur > oxides of carbon.
Among oxides of carbon acidic character increases with the oxidation number of carbon. So, $^{+4}CO_2$ is more acidic than CO. Hence the sequence of acidic character is $N_2O_5 > SO_2 > CO_2 > CO$

**8.** **(c)** The ionization energy increases with decrease in size. Further the element having stable configuration has higher ionisation energy than expected. Hence the ionization energy of nitrogen (Z = 7) is more than oxygen (Z = 8) and carbon (Z = 6) because it has half-filled *p*-orbitals.
$^6C = 1s^2 2s^2 2p^2$ ; $_7N = 1s^2 2s^2 2p^3$ ; $_8O = 1s^2 2s^2 2p^4$
Hence the correct order should be C < N > O

**9.** **(b)** Along the period, I.P. generally increases but not regularly. Be and B are exceptions. First I.P. increases in moving from left to right in a period, but I.P. of B is lower than Be.

**10.** **(d)**

**11.** **(d)** The electronic configuration of the given ions are as follows.
$_{12}Mg^{2+} = 1s^2, 2s^2 2p^6$ (No unpaired electron)
$_{22}Ti^{3+} = 1s^2, 2s^2 2p^6, 3s^2 3p^6 3d^1$ (One unpaired electron)
$_{23}V^{3+} = 1s^2, 2s^2 2p^6, 3s^2 3p^6 3d^2$
(Two unpaired electrons)
$_{26}Fe^{2+} = 1s^2, 2s^2 2p^6, 3s^2 3p^6 3d^6$
(Four unpaired electrons)

**12.** **(b)** $IE_2$ of Mg is lower than that of Na because in case of $Mg^+$, 3*s*-electron has to be removed whereas in case of $Na^+$, an electron is removed from the stable inert gas configuration which is difficult.

**13.** **(b)** According to modern periodic law, the properties of the elements are repeated after certain regular intervals when these elements are arranged in order of their increasing atomic numbers.

**14.** **(a)** For isoelectronic species, size of anion increases as negative charge increases whereas size of cation decreases with increase in positive charge. Further ionic radii of anions is more than that of cations. Thus the correct order is $Ca^{++} < K^+ < Ar < Cl^- < S^{--}$

**15.** **(b)** The alkali metals are highly reactive because their first ionisation potential is very low and hence they have great tendency to loses electron to form unipositive ion.
On moving down group- I from Li to Cs ionisation enthalpy decreases hence the reactivity increases. The halogens are most reactive elements due to their low bond dissociation energy, high electron affinity and high enthalpy of hydration of halide ion. However their reactivity decreases with increase in atomic number

**16.** **(b)** In hydrides of 15th group elements, basic character decreases on descending the group i.e.
$NH_3 > PH_3 > AsH_3 > SbH_3$.

**17.** **(b)** The right sequence of $I.E_1$ of Li < B < Be < C.

**18.** **(b)** As we move down in a group electron gain enthalpy becomes less negative because the size of the atom increases and the distance of added electron from the nucleus increases. Negative electron gain enthalpy of F is less than Cl. This is due to the fact that when an electron is added to F, the added electron goes to the smaller n = 2 energy level and experiences significant repulsion from the other electrons present in this level. In Cl, the electron goes to the larger n = 3 energy level and consequently occupies a larger region of space leading to much less electron–electron repulsion. So the correct order is Cl > F > Br > I.

**19. (a)** On moving along a period ionic radii decreases due to increase in effective nuclear charge.

**20. (a)** As the nuclear charge increases, the force of attraction between the nucleus and the incoming electron increases and hence the elecron gain enthalpy becomes more negative, hence the correct order is

$Ca < Al < C < O < F$

**21. (a)** First period has H and He only out of which He is inert, hence, H behaves as a highly electropositive as well as electronegative.

**22. (a)** $O^{--}$ and $F^-$ are isoelectronic. Hence have same number of shells, therefore greater the nuclear charge smaller will be the size i.e.

$$O^{--} > F^-$$

further $Li^+$ and $B^{3+}$ are isoelectronic. therefore

$$Li^+ > B^{3+}$$

Hence the correct order of atomic size is.

$$O^{--} > F^- > Li^+ > B^{3+}$$

**23. (d)** As the size increases the basic nature of oxides changes to acidic nature i.e., acidic nature increases.

$$\underset{\text{Acidic}}{SO_2} > \underset{\text{Weak acidic}}{P_2O_3} > \underset{\text{Amphoteric}}{SiO_2} > Al_2O_3$$

$SO_2$ and $P_2O_3$ are acidic as their corresponding acids $H_2SO_3$ and $H_3PO_3$ are strong acids.

**24. (a)** For isoelectronic species ionic radii decreases as the charge on ion decreases. Further on moving down in a group ionic radii increases. Hence the correct order is $O^{2-} < N^{3-} < S^{2-} < P^{3-}$

**25. (a)** CaO is basic as it form strong base $Ca(OH)_2$ on reaction with water.

$$CaO + H_2O \longrightarrow Ca(OH)_2$$

$CO_2$ is acidic as it dissolve in water forming unstable carbonic acid.

$$H_2O + CO_2 \longrightarrow H_2CO_3$$

Silica ($SiO_2$) is insoluble in water and acts as a very weak acid.

$SnO_2$ is amphoteric as it reacts with both acid and base.

$$SnO_2 + 2H_2SO_4 \longrightarrow Sn(SO_4)_2 + 2H_2O$$

$$SnO_2 + 2KOH \longrightarrow K_2SnO_3 + H_2O$$

**26. (a)** Incoming electrons occupies the smaller n = 2 shell, also negative charge on oxygen ($O^-$) is another factor due to which incoming electron feel repulsion.

Hence electron repulsion outweigh the stability gained by achieving noble gas configuration.

**27. (b)** In the isoelectronic species, all isoelectronic anions belong to the same period and cations to the next period.

**28. (c)** I represents Li, II represents K

III represents Br, IV represents I

V represents He

So, amongst these, II represents most reactive metal and V represents least reactive non-metal.

**29. (d)**

**30. (d)**

| | |
|---|---|
| Helium (He) $1s^2$ | → Highest ionisation energy due to noble gas in nature. |
| Fluorine (F) $1s^2, 2s^2 2p^3$ | → High electronegativity in nature due to small size and –1 oxidation state. |
| Rubidium (Rb) | → Most electronegative element due to large atomic size. |
| Lithium (Li) | → Strongest reducing agent due to small size and positive oxidation state (+1) |