

# Periodic Table and Periodicity

## Question1

Given below are the atomic masses of the elements:

Element:	Li	Na	Cl	K	Ca	Br	Sr	I	Ba
Atomic Mass ( $\text{g mol}^{-1}$ ):	7	23	35.5	39	40	80	88	127	137

Which of the following doesn't form triad?

### KCET 2025

Options:

- A. Ba, Sr, Ca
- B. Cl, Br, I
- C. Cl, K, Ca
- D. Li, Na, K

Answer: C

Solution:

Elements in triad should have similar properties K, Ca are metals Cl is non metals

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## Question2

The correct order of first ionisation enthalpy of given elements is

### KCET 2023

Options:

- A.  $\text{Li} < \text{B} < \text{Be} < \text{C}$



B.  $\text{Be} < \text{Li} < \text{B} < \text{C}$

C.  $\text{C} < \text{B} < \text{Be} < \text{Li}$

D.  $\text{Li} < \text{Be} < \text{B} < \text{C}$

**Answer: A**

### Solution:

Ionisation enthalpy of elements generally increases on going from left to right along a period.

But Be has a half-filled electronic configuration which requires more energy to ionise as compared to B. Thus, the correct order will be  $\text{Li} < \text{B} < \text{Be} < \text{C}$ .

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## Question3

**A pair of amphoteric oxides is**

### KCET 2023

**Options:**

A.  $\text{Al}_2\text{O}_3, \text{Li}_2\text{O}$

B.  $\text{BeO}, \text{BO}_3$

C.  $\text{BeO}, \text{MgO}$

D.  $\text{BeO}, \text{ZnO}$

**Answer: D**

### Solution:

$\text{BeO}$ ,  $\text{Al}_2\text{O}_3$  and  $\text{ZnO}$  are amphoteric in nature.  $\text{MgO}$  and  $\text{Li}_2\text{O}$  are basic in nature whereas  $\text{BO}_3$  is acidic. Thus, the pair of amphoteric oxides are  $\text{BeO}$  and  $\text{ZnO}$ .

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## Question4

**In which one of the following pairs, both the elements does not have  $(n - 1)d^{10}ns^2$  configuration in its elementary state?**



## KCET 2023

### Options:

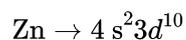
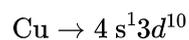
- A. Zn, Cd
- B. Cd, Hg
- C. Hg, Cn
- D. Cu, Zn

**Answer: D**

### Solution:

Among the given elements copper and does not have  $(n - 1)d^{10}ns^2$  configuration while zinc have this configuration in its elementary state.

Thus in option (d) both the elements don't have  $(n - 1)d^{10}ns^2$  configuration



## Question5

**Amphoteric oxide among the following**

## KCET 2022

### Options:

- A. CO<sub>2</sub>
- B. Ag<sub>2</sub>O
- C. SnO<sub>2</sub>
- D. BeO

**Answer: C**

### Solution:

SnO<sub>2</sub> and BeO both are amphoteric in nature.

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## Question6

The property of halogens which is not correctly matched is

**KCET 2022**

**Options:**

- A.  $F > Cl > Br > I$  (Electronegativity)
- B.  $I > Br > Cl > F$  (Density)
- C.  $F > Cl > Br > I$  (Electron gain enthalpy)
- D.  $F > Cl > Br > I$  (Ionisation enthalpy)

**Answer: C**

**Solution:**

Down the group, electron gain enthalpies become less and less negative with the increase in the size of the halogen. However, electron gain enthalpy of F is less negative than Cl. This is due to small size of F-atom. As a result, there are strong inter electronic repulsions in the relatively small  $2p$ -orbitals of F and thus incoming electrons experience much less attraction. Thus, the correct order is  $Cl > F > Br > I$ .

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## Question7

Which noble gas has least tendency to form compounds?

**KCET 2022**

**Options:**

- A. Ne
- B. Ar
- C. Kr
- D. He

**Answer: D**

**Solution:**

Noble gas has least tendency to form compounds with helium due to highest ionisation enthalpy.

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## Question8

Elements  $X$ ,  $Y$  and  $Z$  have atomic numbers 19, 37 and 55 respectively. Which of the following statements is true about them ?

### KCET 2022

Options:

- A.  $Y$  would have an ionisation potential between those of  $X$  and  $Z$ .
- B.  $Z$  would have the highest ionisation potential.
- C.  $Y$  would have the highest ionisation potential.
- D. Their ionisation potential would increase with increasing atomic number.

**Answer: A**

**Solution:**

Elements  $X$ ,  $Y$  and  $Z$  with atomic number 19, 37 and 55 respectively K, Pb and Cs. These elements are belongs to group-I of periodic table. On moving down the period in group-I ionisation potential will decrease down the group. Thus, the order is  $X > Y > Z$ .

Therefore, statement (a) is correct.

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## Question9

The third ionisation enthalpy is highest in

### KCET 2021

Options:

- A. alkali metals
- B. alkaline earth metals
- C. chalcogens
- D. pnictogens

**Answer: B**

**Solution:**

The third ionisation enthalpy is highest in a alkaline earth metals because it achieves stable noble gas configuration after removal of two electrons. Further removal of electron from the completely filled orbital require high ionisation enthalpy.

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## Question10

**The first ionisation enthalpy of the following elements are in the order :**

**KCET 2019**

**Options:**

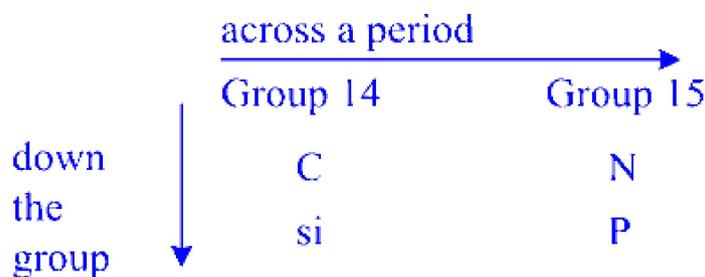
- A.  $C < N < Si < P$
- B.  $P < Si < N < C$
- C.  $P < Si < C < N$
- D.  $Si < P < C < N$

**Answer: D**

**Solution:**

Key Idea Ionisation enthalpy represents the energy required to remove an electron from an isolated gaseous atom ( $X$ ) in its ground state.

The correct order for first ionisation enthalpy is  $Si < P < C < N$ . Generally it increases as we go across a period and decreases as we descend in a group. The position of given four elements in the periodic table is as follows



On moving across a period, increasing nuclear charge outweighs the shielding. Consequently the outermost electrons are held more and more tightly and ionisation enthalpy increases across a period. On moving down the group, increase in shielding outweighs the increasing nuclear charge and thus, removal of outermost electron requires less energy.

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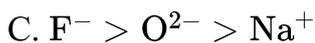
## Question11



## Which of the following is the correct order of radius?

### KCET 2018

#### Options:



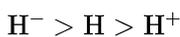
**Answer: A**

#### Solution:

Let's analyze each option step by step, keeping in mind that the effective radius of an ion or atom depends on its electron cloud and the nuclear charge. A useful principle is:

- For species with similar electron configurations (isoelectronic species), a higher nuclear charge (more protons) pulls the electrons closer, resulting in a smaller radius.

Now, let's evaluate each option:

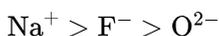


$\text{H}^-$  (hydride ion) has one extra electron compared to neutral hydrogen. The extra electron-electron repulsion tends to expand the electron cloud, making it larger than neutral H.

Neutral H has a single electron.

$\text{H}^+$  is simply a bare proton with no electron cloud, so it is very small.

Therefore, the order  $\text{H}^- > \text{H} > \text{H}^+$  is correct.



Notice that  $\text{Na}^+$ ,  $\text{F}^-$ , and  $\text{O}^{2-}$  are all isoelectronic (each has 10 electrons).

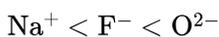
Their radii should decrease as the nuclear charge increases:

$\text{Na}^+$  (11 protons) should be the smallest.

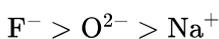
$\text{F}^-$  (9 protons) is intermediate.

$\text{O}^{2-}$  (8 protons) should be the largest.

The correct order should be:

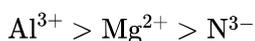


Hence, Option B is incorrect.



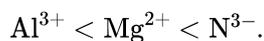
Based on the above isotope series,  $\text{O}^{2-}$  should be bigger than  $\text{F}^-$  because it has a lower nuclear charge, which contradicts this order.

Thus, Option C is also incorrect.



Here,  $\text{Al}^{3+}$ ,  $\text{Mg}^{2+}$ , and  $\text{N}^{3-}$  are isoelectronic (each has 10 electrons).

A higher nuclear charge means a smaller radius, so we expect



Option D represents the reverse order, making it incorrect.

In summary, the only option that correctly represents the order of radii is:



Thus, the correct answer is Option A.

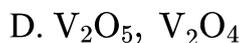
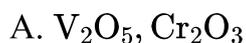
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## Question 12

**Which of the following is an amphoteric oxide?**

**KCET 2018**

**Options:**



**Answer: A**

**Solution:**

An amphoteric oxide is one that can react both as an acid and as a base. A classic example is chromium(III) oxide, which reacts with acids to form chromium(III) salts and with bases to form chromite complexes.

Let's briefly analyze the oxides in the options:



- This oxide is well known to be amphoteric.



• Vanadium here is in the +5 oxidation state. Such high-oxidation-state oxides are generally acidic rather than amphoteric (although under very special conditions, some behavior might be more complex).



- With manganese in the +7 oxidation state, this oxide is very acidic.



- Chromium(II) oxide is typically basic.



• This corresponds to vanadium in the +4 oxidation state and is closer to being amphoteric than  $V_2O_5$ , but it is not as well-known or classic an example as  $Cr_2O_3$ .

Among the pairs given, the only unmistakably amphoteric oxide is  $Cr_2O_3$ . (Even though some of the other oxides might have interesting reactivities, only  $Cr_2O_3$  clearly exhibits the dual acidic–basic behavior that defines amphotericism.)

Thus, the answer is the option that contains  $Cr_2O_3$  as the amphoteric oxide. That is:

Option A:  $V_2O_5$ ,  $Cr_2O_3$

Here, despite  $V_2O_5$  being acidic, the oxide in question that is amphoteric is  $Cr_2O_3$ .

So the correct answer is Option A.

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## Question 13

**The electronic configuration of transition element " X ",  $[Ar]3d^5$  is oxidation state is +3 . What is its atomic number?**

### KCET 2018

#### Options:

A. 25

B. 26

C. 27

D. 24

**Answer: B**

#### Solution:

To find the atomic number of the transition element "X" with the given electronic configuration  $[Ar] 3d^5$  in a +3 oxidation state, we must determine the original number of electrons before it lost three electrons.

#### Oxidation State Explanation:

The element X is in the +3 oxidation state, which means it has lost three electrons. Therefore, when we add these three electrons back, we get the electron configuration of the neutral atom.

#### Electron Addition:

According to electron addition rules:

Two electrons are typically added to the 4s orbital.

One electron is added to the 3d orbital.

#### Calculating Total Electrons:

The given configuration  $[Ar] 3d^5$  refers to the ion.

When we neutralize the charge by re-adding the three lost electrons:

18 electrons come from the [Ar] configuration.

5 electrons are from the  $3d$  subshell.

3 additional electrons need to be added (2 to the  $4s$  and 1 to the  $3d$ ), totaling 26 electrons.

**Determining Atomic Number:**

Since a neutral atom has an equal number of protons and electrons, the total number of electrons corresponds to the atomic number.

The atomic number of element X is 26.

Thus, the atomic number of the transition element X is 26.

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## Question14

**The electronegativities of C, N, Si and P are in the order of**

**KCET 2017**

**Options:**

A.  $P < Si < C < N$

B.  $Si < P < C < N$

C.  $P < Si < N < C$

D.  $Si < P < N < C$

**Answer: B**

**Solution:**

Electronegativity increases as we move left to right in a period and decreases as we move down in the group.

(i) C and N belong to the same period. Hence N has more electronegativity than carbon (C).

(ii) In the same way P is more electronegative than Si .

(iii) As Si is below the carbon is 14th group the electronegativity of carbons is more than of Si .

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## Question15

**Which one of the following noble gas has an unusual property of diffusing through the materials such as rubber, glass or plastic?**

**KCET 2017**

**Options:**

A. Kr

B. Ne

C. Ar

D. He

**Answer: D**

### **Solution:**

Helium is the second lightest element. Helium is used for many purpose that require some of its unique properties such as its low boiling point, low density, low solubility high thermal conductivity or inertness helium diffuses through solids three times faster than air.

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