SmartKalike

CBSE Class 12 · Chemistry

The d-and f-Block Elements

10 most probable questions for Boards 2027

Q1. 1 mark · Multiple choice

Which statement correctly explains the classification of scandium and zinc?
(A) Sc is a transition element because it has an incompletely filled 3d orbital; Zn is not because its d orbitals are filled in the atom and oxidised state.
(B) Both are transition elements because both belong to the d-block.
(C) Zn is a transition element because it has a filled d orbital; Sc is not because it has an s electron.
(D) Neither is a transition element because both have an ns orbital.

Answer

(A) Sc is a transition element because it has an incompletely filled 3d orbital; Zn is not because its d orbitals are filled in the atom and oxidised state. — Sc has an incompletely filled 3d orbital, whereas Zn has completely filled d orbitals in its ground and oxidised states.

Q2. 2 marks · Short answer

State two characteristic properties of transition elements that arise from their partly filled d orbitals.

Answer

1. Partly filled d orbitals protrude to the atom's periphery, making transition elements more influenced by their surroundings; these d orbitals also affect surrounding atoms or molecules.
2. Ions with the same d^n configuration (n = 1–9) show similar magnetic and electronic properties.

Q3. 3 marks · Medium answer

Explain why Zn, Cd, Hg and Cn are not regarded as transition elements, referring to their d-orbital configurations in the ground state and common oxidation states.

Answer

1. The outer-orbital electronic configurations of Zn, Cd, Hg and Cn are represented by the general formula $(n-1)d^{10}ns^2$, so their d orbitals are completely filled in the ground state.
2. Their d orbitals remain completely filled in their common oxidation states as well; therefore, Zn, Cd, Hg and Cn are not regarded as transition elements.

Q4. 5 marks · Long answer

Explain why transition metals generally have high melting points and high enthalpies of atomisation. Describe the general trend in melting points across a transition series, including the approximate position of the maximum and the stated exceptions.

Answer

Transition metals generally have high melting points and high enthalpies of atomisation because

their valence electrons form strong interatomic metallic bonds.
1. Electrons from (n−1)d orbitals, in addition to ns electrons, participate in interatomic metallic bonding. The greater number of participating electrons strengthens the bonding and requires more energy to melt the metal.
2. Enthalpies of atomisation are high, with maxima at about the middle of each series. One unpaired electron per d orbital is particularly favourable for strong interatomic interaction; in general, more valence electrons produce stronger bonding.
3. Within a transition series, melting points generally rise to a maximum at d^5, except for the anomalous values of Mn and Tc. After the maximum, melting points fall regularly as atomic number increases.
Thus, strong interatomic metallic bonding accounts for the generally high melting points and high enthalpies of atomisation of transition metals.

Q5. 6 marks · Very long answer

(a) Define actinoid contraction and explain why it is greater than lanthanoid contraction. (b) Explain why actinoids show a wider range of oxidation states. (c) State the common oxidation state of actinoids and describe the trend in the highest oxidation state among the early members of the series.

Answer

Actinoids show gradual changes in size and a wide range of oxidation states.

1. Actinoid contraction is the gradual decrease in the size of atoms or M^{3+} ions across the actinoid series. The contraction is greater from element to element than lanthanoid contraction because 5f electrons shield the nuclear charge poorly.

2. Actinoids show a greater range of oxidation states because the 5f, 6d and 7s levels have comparable energies. The 5f electrons participate in bonding to a far greater extent than 4f electrons.

3. The actinoids show the +3 oxidation state in general and form more compounds in the +3 state than in the +4 state. Both +3 and +4 ions tend to hydrolyse.

4. The maximum oxidation state increases across the early members from +4 in Th to +5 in Pa, +6 in U and +7 in Np.

5. Higher oxidation states occur frequently in the first half of the series, but the maximum oxidation state decreases in succeeding elements.

The oxidation-state pattern is uneven, with the early and later actinoids differing considerably.

Q6. 1 mark · Multiple choice

Which statement best explains why copper does not liberate hydrogen from ordinary acids? (A) Copper has a positive standard electrode potential; it reacts with oxidising acids such as nitric acid and hot concentrated sulfuric acid. (B) Copper has a highly negative standard electrode potential and reacts with all acids. (C) Copper reacts with acids only because they oxidise hydrogen ions. (D) Copper’s hydration enthalpy is sufficient to make it displace hydrogen from every acid.

Full answer on SmartKalike: https://smartkalike.com/cbse/class-12/chemistry/the-d-and-f-block-elements

Q7. 2 marks · Short answer

Explain the general trend towards less negative M^{2+}/M standard electrode potentials across the first transition series.

Full answer on SmartKalike: https://smartkalike.com/cbse/class-12/chemistry/the-d-and-f-block-elements

Q8. 3 marks · Medium answer

The M^{2+}/M electrode potentials of Mn, Ni and Zn are more negative than the general trend predicts. State this exception and give reasons for the anomalous values.

Full answer on SmartKalike: https://smartkalike.com/cbse/class-12/chemistry/the-d-and-f-block-elements

Q9. 5 marks · Long answer

Explain why the M^{3+}/M^{2+} electrode potential is high for Zn and comparatively low for V, referring to the electronic stability of the relevant ions.

Full answer on SmartKalike: https://smartkalike.com/cbse/class-12/chemistry/the-d-and-f-block-elements

Q10. 1 mark · Very short answer

What stable d-electron configuration is common to Mn^{2+} and Fe^{3+}?

Full answer on SmartKalike: https://smartkalike.com/cbse/class-12/chemistry/the-d-and-f-block-elements

Unlock all answers on SmartKalike

Every probable question of every chapter, each with a full answer, plus study targets and answer-sheet checking.

https://smartkalike.com/cbse/class-12/chemistry/the-d-and-f-block-elements

Sign up with a friend's email for 30% off their first purchase.