Previous HSE questions from the chapter 'd and f block elements'

- 1. What is the magnetic moment of an atom having d^{10} configuration? (1)
- 2. Describe lanthanoid contraction. Write any two consequences of it. (3) [SAY 2018]
- 3. What is the structure of chromate ion $((CrO_4^{-2}))$?
- 4. Give reasons for the following :
- 5. (a) Transition metals and many of their compounds act as catalyst. (1)
 (b) Scandium (Z = 21) does not exhibit variable oxidation state and yet it is regarded as a transition element. (1)
 (c) Write the steps involved in the preparation of Na₂CrO₄ from chromite ore. (1) [March 2018]

(1)

- 6. a) Zr and Hf are having similar chemical properties. This is due to (1)
 - b) 'Magnetic moments arise due to the presence of unpaired electrons'.
 - Calculated magnetic moments of two transition metal ions are given below.

lon	Calculated magnetic moment		
Sc ³⁺	0		
Ti ³⁺	1.73		

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[SAY 2017]

Justify these observations on the basis of spin only formula. (2)

- c) Transition metal ions are generally coloured. Why? (1)
- 7. a) Transition elements are'd' block elements.
 - i) Write any four characteristic properties of transition elements. (2)
 - ii) Cr²⁺ and Mn³⁺ have d⁴ configuration. But Cr²⁺ is reducing and Mn³⁺ is oxidising. Why? (1)
 b) Which of the following is not a Lanthanoid element?
 - i) Cerium ii) Europium iii) Lutetium iv) Thorium (1) [March 2017]
- 8. Transition elements are d-block elements and inner transition elements are f-block elements.
 - (i) Write any two properties of transition elements. (1)
 - (ii) Name a transition metal compound and write one use of it. (1)
 - (iii) What is Lanthanoid contraction? (1)
 - (iv) Write any two consequences of Lanthanoid contraction. (1) [SAY 2016]
- 9. a) Which of the following oxidation state is not shown by Manganese?

(i) +1 (ii) +2 (iii) +4 (iv) +7 (1)

- b) Represent the structure of dichromate ion. (1)
- c) Potassium permanganate (KMnO₄) is a strong oxidizing agent. Write oxidizing reactions of KMnO₄. (2)

[March 2016]

- 10. a) Which of the following oxidation state is common for lanthanides?
 - i) +2 ii) +3 iii) +4 iv) +5 (1)
 - b) Draw the structures of chromate and dichromate ions. (1)
 - c) Zirconium (Zr) belongs to '4d' and Hafnium (Hf) belongs to '5d' transition series. It is difficult to separate them. Explain. (2) [SAY 2015]
- 11. Fourteen elements following Lanthanum are called Lanthanoids:
 - a) What is Lanthanoid contraction? Give reason for it? (2)
 - b) KMnO₄ is a purple coloured crystal and it acts as an oxidant. How will you prepare KMnO₄ from MnO₂?
 (2) [March 2015]
- 12. Potassium dichromate is an orange coloured crystal and is an important compound used as an oxidant in many reactions.
 - a) How do you prepare $K_2Cr_2O_7$ from chromite ore? (3)
- b) How will you account for the colour of potassium dichromate crystals? (1) [March 2014]
- 13. Potassium permanganate and potassium dichromate are two transition metal compounds.
 - a) Write any four characteristics of transition metals. (2)
 - b) i) Write any two uses of potassium permanganate. (1)
 - i) Draw the structure of dichromate ion. (1) [SAY 2014]
- 14. Account for the following trends in atomic and ionic radii of transition elements.

- a) Ions of the same charge in a given series (3d, 4d or 5d) show progressive decrease in radii with increasing atomic number. (1)
- b) The atomic radii of elements in 4d series are more than that of corresponding elements in 3d series.
 (1)
- c) The atomic radii of the corresponding elements in 4d series and 5d series are virtually the same. (2)
 [March 2013]
- 15. d block elements belong to groups 3 12 in the periodic table, in which the d orbitals are progressively filled.

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- a) What is their common oxidation state? (½)
- b) Name two important compounds of transition elements. (1)
- c) Transition elements form a large number of complex compounds. Why? $(1\frac{1}{2})$
- d) What is misch metal? (1) [SAY 2013]
- 16. Assume that you are going to present a seminar on transition elements. Prepare a seminar paper by stressing any four important properties of transition elements. (4) [SAY 2012]
- 17. a) Potassium dichromate ($K_2Cr_2O_7$) is an important compound of chromium. Describe the method of preparation of potassium chromate from chromite ore. (3)

b) The gradual decrease in the size of lanthanoid elements from lanthanum to lutetium is known as lanthanoid contraction. Write any one consequence of lanthanoid contraction. (1) [March 2012]

18. a) Atomic size increases as we come down a group, but in 4th group of the periodic table, Zr and Hf have almost similar atomic size. Why? (1½)

b) E^0 (std. electrode potential) values generally become less negative as we move across a transition series, but E^0 values of Ni/Ni²⁺ and Zn/Zn²⁺ values are exceptions. Justify. (2½) [March 2011]

- 19. Transition elements are d-block elements, with some exceptions. Usually they are paramagnetic. They show variable oxidation states. They and their compounds show catalytic activity.
 - a) Zn (atomic number = 30) is not a transition element, though it is a d block element. Why? (1)
 - b) Which is more paramagnetic, Fe^{2+} or Fe^{3+} ? Why? (1)
 - c) Why do transition elements show variable oxidation states? (1)
 - d) What is the reason for their catalytic property? (1) [SAY 2011]
- 20. a) Transition elements are d-block elements. Write any 4 properties of transition elements? (2)
 - b) Lanthanoids and actinoids are f-block elements.
 - i) What is the common oxidation state of Lanthanoids? (½)
 - ii) Name the Lanthanoid with common oxidation state +4. (1_2)
 - iii) It is difficult to separate Lanthanoids in the pure state. Explain. (1) [March 2010]
- 21. Potassium permanganate is a violet crystal. What are the products obtained on strong heating of KMnO₄ crystals? Write the balanced chemical equation.
 (2) [March 2010]
- 22. Potassium permanganate is a powerful oxidising agent in neutral, acidic and alkaline medium. In the lab, students were asked to convert an iodide to iodate. One of the students obtained I₂ instead of iodate.
 - a) i) What is the reaction to be carried out by the students who got iodate? Write the chemical equation.
 (1½)
 - ii) What may be the reaction carried out by the student who got I_2 as one of the products? (1)
 - b) i) Suppose you are going the same experiment with the iodide using Potassium dichromate ($K_2Cr_2O_7$). What are the products going to be obtained? Write down the chemical equation. (1½)
 - ii) What is Baeyer's reagent? (1) [March 2009]
- 23. Potassium permanganate and Potassium dichromate are oxidising agents.
 - a) Name the ores of the above compounds from which they are prepared. ($\frac{1}{2}$)
 - b) Give one example each for the oxidising property of them. Write down the balanced chemical equation.(2) [March 2009]
- 24. Transition elements show variable oxidation states and many of the transition metal ions are attracted by a magnetic field.
 - a) Give reason for variability of oxidation state. (1)
 - b) Name the two types of magnetic behaviour. (1)

- c) The observed magnetic moment of Sc³⁺ was found to be zero. Calculate the magnetic moment of Sc³⁺ using the spin-only formula and compare the result of observed and calculated magnetic moment. (2) [March 2008]
- 25. A list of Lanthanide ions are given:
 - La³⁺, Ce⁴⁺, Yb²⁺, Lu³⁺ Atomic numbers of La, Ce, Yb and Lu are 57, 58, 70 and 71 respectively.
- a) Give the number of unpaired electrons in each ion. (1)
- b) Identify the ions which are paramagnetic. Justify. $(1\frac{1}{2})$

c) Identify the ions which are colourless. Give reason. (1½) [SAY 2008]

