28. Chemistry of transition elements

28.1 General physical and chemical properties of the first row of transition elements, titanium to copper

Paper 4

Question Paper

1 **(a)** **(i)** Define transition element.

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..... [1]

(ii) Explain why transition elements can form complex ions.

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..... [1]

2 **(a)** **(i)** Explain why transition elements have variable oxidation states.

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..... [1]

(ii) Sketch the shape of a $3d_{z^2}$ orbital in Fig. 4.1.

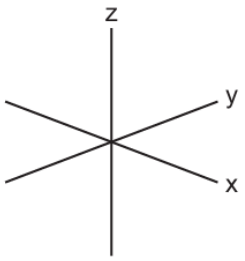

Fig. 4.1

[1]

3 **(b)** Catalysts may be homogeneous or heterogeneous.

(i) Platinum is a transition element. Explain why transition elements behave as catalysts.

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..... [1]

4 **(a)** State **two** typical chemical properties of a transition element.

1 .....

2 .....

[1]

5 Transition elements behave as catalysts and can form complex ions.

(a) Explain why transition elements behave as catalysts.

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..... [2]

6 **(a)** Define transition element.

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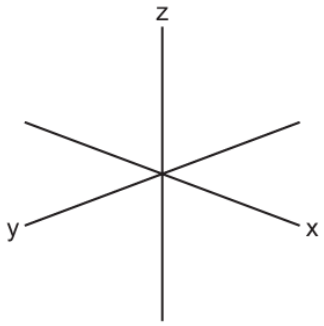
..... [1]

(b) Sketch the shape of a $3d_{z^2}$ orbital.



[1]

7 **(d)** **(i)** Explain why transition elements can form complex ions.

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..... [1]

8 **(a)** Explain why transition elements have variable oxidation states.

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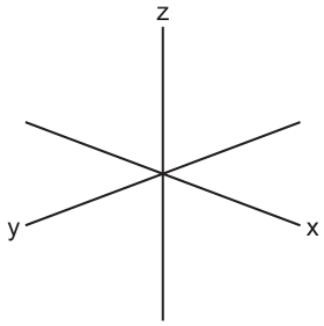
..... [1]

(b) Sketch the shape of a $3d_{xy}$ orbital.

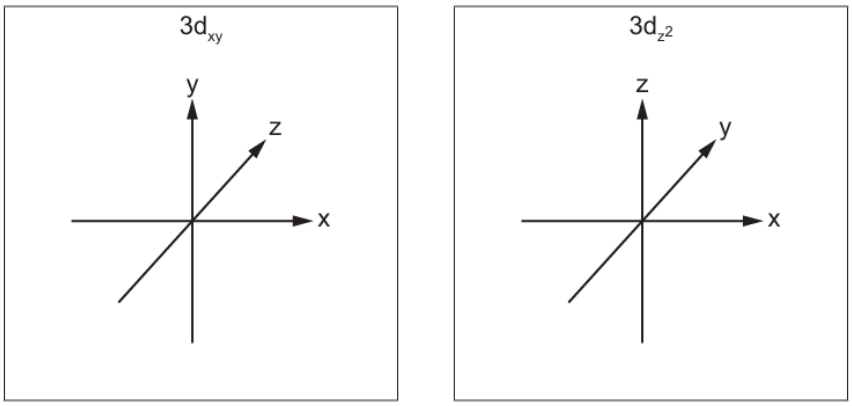


[1]

9 A transition element is a d-block element which forms one or more stable ions with incomplete d-orbitals.

(a) Two of the 3d orbitals are the $3d_{xy}$ orbital and the $3d_{z^2}$ orbital.

Sketch the shapes of these two orbitals.



[1]

10 Copper is a transition element. It forms a wide variety of compounds.

(a) Define transition element.

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..... [1]

11 **(a)** The electronic configuration of transition element **Q** is [Ar] $3d^2\ 4s^2$.

Predict the likely oxidation states of element **Q** in compounds.

..... [1]

(b) Suggest why transition elements often show variable oxidation states in their compounds, but typical s-block elements such as calcium do not.

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..... [1]

12 **(a)** Define the term *transition element*.

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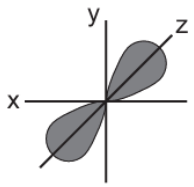
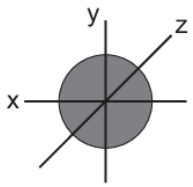
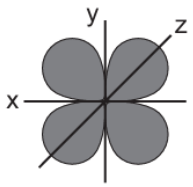
..... [1]

13 **(a)** Sketches of the shapes of some atomic orbitals are shown.

Identify the type of orbital, s, p, or d.

shape of orbital			
type of orbital			

[1]

(b) Cadmium forms the two ions, Cd_2^{2+} and Cd^{2+}. The electronic configuration of cadmium in these ions is shown.

- [Kr] $4d^{10}5s^1$
- [Kr] $4d^{10}$

Use this information to explain why cadmium is **not** a transition element.

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..... [1]

14 **(b)** Copper(I) and silver(I) salts are colourless.

Suggest why.

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..... [2]

15 **(c)** Give the formulae of two oxides of iron. State the oxidation number of iron in each compound.

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..... [1]

16 Manganese, chromium and ruthenium are all transition elements.

(a) Explain what is meant by a *transition element*.

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..... [1]