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CHEMISTRY

PHYSICAL CHEMISTRY II

Level & Board	AQA (A-LEVEL)
TOPIC:	TRANSITION METALS
PAPER TYPE:	QUESTION PAPER - 5
TOTAL QUESTIONS	10
TOTAL MARKS	28

Transition Metals - 5

1. In catalytic converters which clean up petrol engine exhaust gases, a catalyst promotes the reduction of nitrogen oxides using another polluting gas as reductant.

State a suitable catalyst for this task, identify the reductant, and write an equation for the reaction that results.

(3)

2. The percentage of iron in a sample of impure iron(II) sulphate crystals can be determined by titrating solutions, made from separate weighed samples acidified with dilute sulphuric acid, against a standard solution of potassium manganate(VII).

Which one of the following would lead to an inaccurate result?

A. transferring the weighed sample of iron(II) sulphate into a wet conical flask
B. failing to measure accurately the volume of water used to dissolve each weighed sample of iron(II) sulphate
C. transferring the standard solution of potassium manganate(VII) from its original container to the burette using a wet beaker
D. failing to measure accurately the volume of dilute sulphuric acid added to the mixture before titration

(1)

3. Deduce the formulae of the following complexes which contain only chloride ions as ligands.

(a) A tetrahedral complex ion of nickel(II)

(1)

(b) An octahedral complex ion of titanium(IV)

(1)

(c) A linear complex ion of copper(I)

(1)

4. Which of the species given below can behave as ligands?

NH_2^- NH_3 NH_4^+

A. all three
B. only NH_3
C. NH_3 and NH_4^+
D. NH_2^- and NH_3

(1)

5. The element palladium is in the d block of the Periodic Table.
Consider the following palladium compound which contains the sulfate ion.

$$[Pd(NH_3)_4]SO_4$$

(a) Give the oxidation state of palladium in this compound.

(1)

(b) Give the names of two possible shapes for the complex palladium ion in this compound.

(2)

6. Which one of the following statements is true?

A. A blue solution containing the ion $[CoCl_4]^{2-}$ turns pink when added to an excess of water.
B. A purple solution is formed when chlorine is bubbled into aqueous sodium bromide.
C. A yellow precipitate is formed when aqueous silver nitrate is added to aqueous sodium chloride.
D. A green solution containing the ion $[CuCl_4]^{2-}$ turns blue when added to an excess of concentrated hydrochloric acid.

(1)

7. Locate the element zirconium (Zr) in the Periodic Table and use its position to help you to answer the following questions.

(a) Give three characteristic features of zirconium chemistry.

(3)

(b) Give the formula of the chloride of zirconium in its highest oxidation state.

(1)

8. Using complex ions formed by Co^{2+} with ligands selected from H_2O, NH_3, Cl^-, $C_2O_4^{2-}$ and $EDTA^{4-}$, give an equation for each of the following.

(a) A ligand substitution reaction which occurs with no change in either the co-ordination number or in the charge on the complex ion.

(2)

(b) A ligand substitution reaction which occurs with both a change in the co-ordination number and in the charge on the complex ion.

(2)

(c) A ligand substitution reaction which occurs with no change in the co-ordination number but a change in the charge on the complex ion.

(2)

(d) A ligand substitution reaction in which there is a large change in entropy.

(2)

9. Platinum compounds are highly toxic.

(a) State why cisplatin is used in cancer treatment despite its toxicity.

(1)

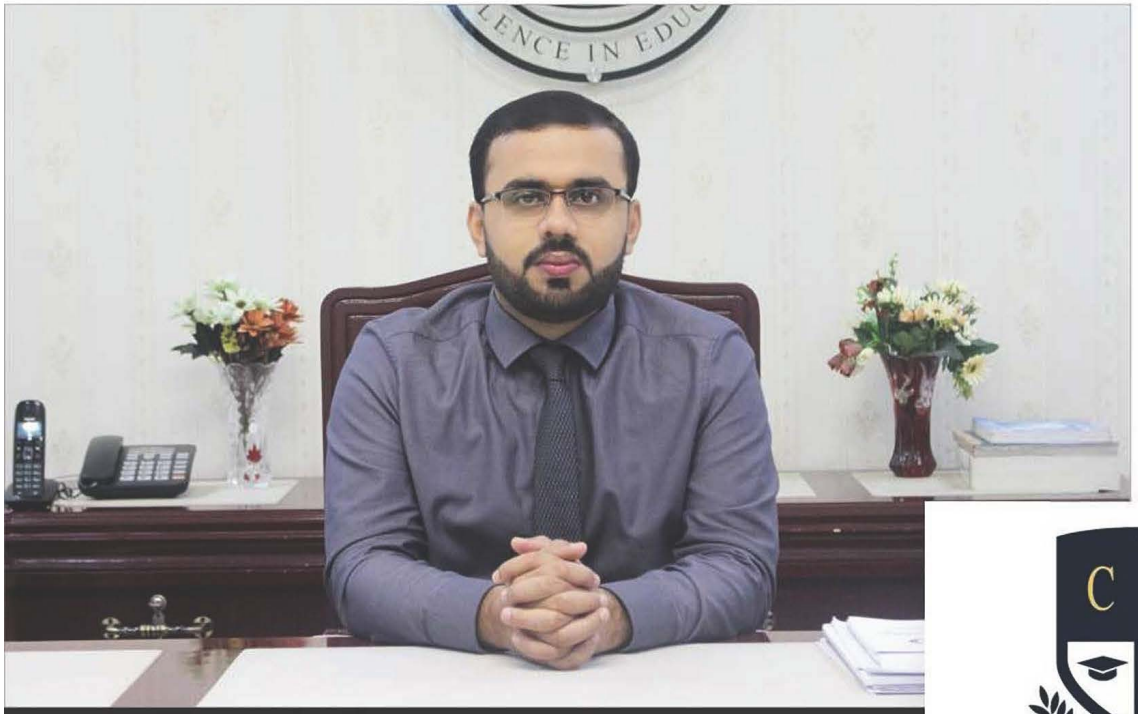
(b) Suggest a suitable precaution that should be taken by medical staff when using cisplatin.

(1)

10. An acidified solution of NH_4VO_3 reacts with zinc.

Explain how observations from this reaction show that vanadium exists in at least two different oxidation states.

(2)



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