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CHEMISTRY

PHYSICAL CHEMISTRY II

Level & Board	AQA (A-LEVEL)
TOPIC:	TRANSITION METALS
PAPER TYPE:	QUESTION PAPER - 6
TOTAL QUESTIONS	10
TOTAL MARKS	28

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Transition Metals - 6

1. Transition elements form complex ions with a range of colours and shapes.

(a) By considering its electron arrangement, state how an element can be classified as a transition element.

(1)

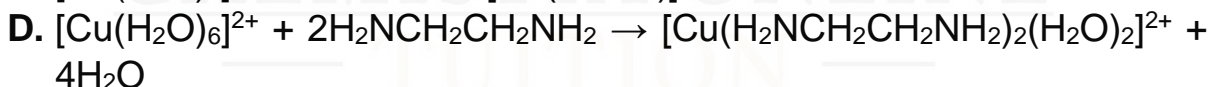
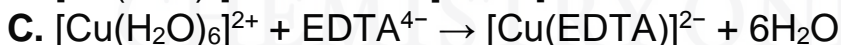
(b) Explain the meaning of the term complex ion.

(2)

(c) In terms of electrons, explain why an aqueous solution of cobalt(II) sulfate has a red colour.

(3)

2. Which one of the following reactions in aqueous solution has the most positive change in entropy?



(1)

3. This question is about transition element.

(a) State what is meant by the term co-ordinate bond.

(2)

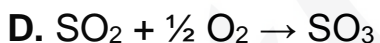
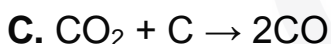
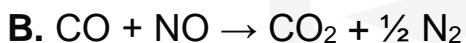
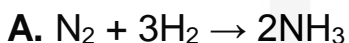
(b) Define the terms Bronsted–Lowry acid and Lewis acid.

(2)

(c) State what is meant by the term bidentate ligand.

(2)

4. In which one of the following reactions is a heterogeneous catalyst not used?



(1)

5. State the electron configuration of a Ti(III) ion and that of a Ti(IV) ion.

Explain, in terms of electron configurations and electron transitions, why Ti(III) compounds are usually coloured but Ti(IV) compounds are colourless.

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(5)

6. Which one of the following would not reduce an acidified aqueous solution of potassium dichromate(VI)?

- A. CH_3COOH
- B. Zn
- C. CH_3CHO
- D. $\text{Fe}^{2+}(\text{aq})$

(1)

7. Silver complexes can be used to identify a particular organic functional group.

Give one example of a silver complex that can be used in this way and state the organic functional group it identifies.

(2)

8. Which one of the following would not react with aqueous silver nitrate to produce a precipitate that is soluble in concentrated aqueous ammonia?

- A. CaBr_2
- B. $[\text{COCl}_4]^{2-}$
- C. $(\text{CH}_3)_4\text{N}^+ + \text{I}^-$
- D. CH_3COCl

(1)

9. The pigment 'Cobalt Yellow' contains an octahedral complex of cobalt(III) and nitrate(III) ions (NO_2^-).

Analysis shows that Cobalt Yellow contains 13.0% of cobalt, 18.6% of nitrogen and 25.9% of potassium by mass.

The remainder is oxygen.

(a) Use these data to calculate the empirical formula of Cobalt Yellow.
Show your working.

(3)

(b) Deduce the structural formula of the cobalt-containing ion in Cobalt Yellow.

(1)

10. Which one of the following can act as an oxidising agent but not as a reducing agent?

A. CH_3CHO

B. Fe^{2+}

C. I^-

D. MnO_4^-

(1)

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