CHEMISTRY ONLINE TUITION

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CHEMISTRY
PHYSICAL CHEMISTRY II

Level & Board	AQA (A-LEVEL)
TOPIC:	TRANSITION METALS
PAPER TYPE:	QUESTION PAPER - 1
TOTAL QUESTIONS	10
TOTAL MARKS	28

Transition Metals - 1

1. A green solution, X, is thought to contain $[Fe(H_2O)_6]^{2+}$ ions.

   The presence of these ions can be confirmed by reacting separate samples of solution X with aqueous ammonia and with aqueous sodium carbonate.
   Write equations for each of these reactions and describe what you would observe.

   (4)

2. Which one of the following electronic configurations is that of a transition element?

   A. [Ar] $4s^2 3d^{10}$
   B. [Ar] $4s^2 3d^9$
   C. [Ar] $4s^2 3d^0$
   D. [Ar] $4s^2 3d^{10} 4p^1$

   (1)

3. A sample of iron is heated with a stream of dry hydrogen chloride.

   A different chloride of iron is formed that contains the Fe^{2+} ion.

   This chloride dissolves in water to form a pale green solution that contains the hexaaquairon(II) complex ion.

   (a) Write the electronic configuration of Fe^{2+}.

(1)

(b) Draw the shape of the hexaaquairon(II) complex ion. Include the bond angles on your diagram.

(2)

(c) Aqueous sodium hydroxide is added to a solution containing Fe^{2+}(aq). State what you would observe.

Write an ionic equation, with state symbols, for the reaction.

(2)

4. Electrons in copper(II) ions can be excited by the absorption of light with a wavelength of 600 nm.

What is the increase in energy, in J, for each electron excited?

Speed of light, $c = 3.00 \times 10^8$ m s^{-1} Planck's constant, $h = 6.63 \times 10^{-34}$ Js

A. 3.98×10^{-40}
B. 1.33×10^{-39}
C. 3.32×10^{-28}
D. 3.32×10^{-19}

(1)

5. When iodine molecules are dissolved in aqueous solutions containing iodide ions, they react to form triiodide ions (I_3^-)

$$I_2 + I^- \rightarrow I_3^{\;-}$$
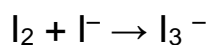
The reaction above between I^- ions and $S_2O_8{}^{2-}$ ions has a high activation energy and $S_2O_8{}^{2-}$ ions are only reduced slowly to $SO_4{}^{2-}$ ions.

The reaction is catalysed by Fe^{2+} ions.

(a) Explain why the reaction between I^- ions and $S_2O_8{}^{2-}$ ions is slow.

(1)

(b) Other than having variable oxidation states, explain why Fe^{2+} ions are good catalysts for this reaction.

(1)

(c) Write a half-equation for the reduction of $S_2O_8{}^{2-}$ ions to $SO_4{}^{2-}$ ions.

(1)

(d) Construct an overall equation for the reaction between $S_2O_8{}^{2-}$ ions and I^- ions.

(1)

6. Which is not a correct statement?

A. Transition metals form coloured ions and complexes
B. Transition metals display variable oxidation states
C. A ligand accepts a pair of electrons from a transition metal
D. A complex is a central metal atom or ion surrounded by ligands

(1)

7. This question is about iron and its ions.

Discuss the role of iron as a heterogeneous catalyst in the Haber process.

$$3H_2 + N_2 \rightleftharpoons 2NH_3$$
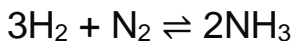
Your answer should include:

- the meaning of the term heterogeneous catalyst
- how iron acts as a heterogeneous catalyst
- the factors that affect the efficiency and lifetime of the catalyst.

(6)

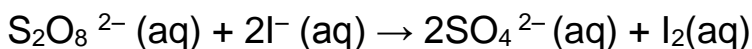**8.** An oxide of vanadium catalyses the following reaction:

$$SO_{2(g)} + \frac{1}{2} O_{2(g)} \rightleftharpoons SO_{3(g)}$$

What is the formula of the vanadium-containing intermediate formed in this reaction?

A. V_2O
B. VO
C. V_2O_3
D. V_2O_4

(1)

9. Fe^{2+} ions catalyse the reaction between peroxodisulfate(VI) ions and iodide ions in aqueous solution.

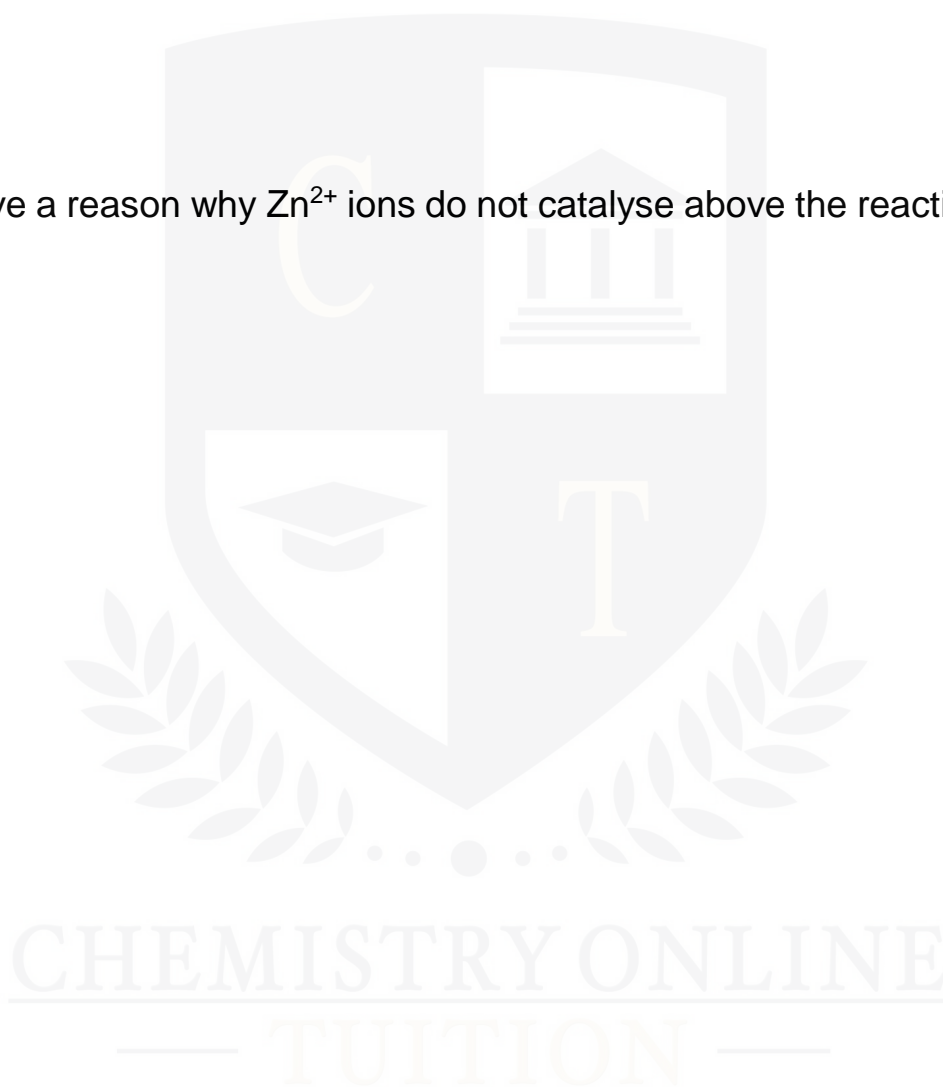$$S_2O_8{}^{2-} (aq) + 2I^- (aq) \rightarrow 2SO_4{}^{2-} (aq) + I_2(aq)$$

(a) Explain why this reaction is slow before the catalyst is added.

Give two equations to show how Fe^{2+} ions catalyse this reaction.

(4)

(b) Give a reason why Zn^{2+} ions do not catalyse above the reaction in part

(1)

I am Sorry !!!!!

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