

**Max. Marks : 19 Marks**

**Time : 19 Minutes**

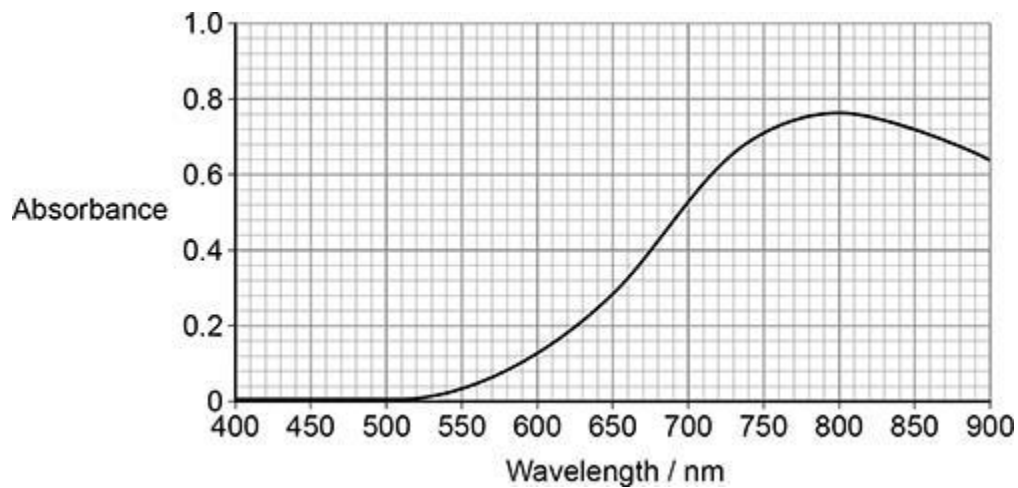
(a) Some complexes containing transition metal ions are coloured.

- Explain why some complexes containing transition metal ions are coloured.
- List the factors that affect the colour.
- Describe how colorimetry can be used to determine the concentration of a coloured complex.

[illegible]

(6)

- (b) The figure below shows the visible spectrum of  $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$



Use the wavelength at the peak of the curve in the figure to calculate the change in energy, in J, of an electron when it absorbs radiation with this wavelength.

The Planck constant,  $h = 6.63 \times 10^{-34} \text{ J s}$

Speed of light,  $c = 3.00 \times 10^8 \text{ m s}^{-1}$

Change in energy \_\_\_\_\_ J

(3)

(Total 9 marks)

Q2.

This question is about complexes of the transition metal chromium.

- (a) State the meaning of the term transition metal complex.

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(1)

$\text{Cr}(\text{PF}_3)_6$  is a complex of chromium that contains molecules of  $\text{PF}_3$

- (b) The electron pair repulsion theory can be used to predict the shape of a  $\text{PF}_3$  molecule.

Draw the shape of a  $\text{PF}_3$  molecule.

Include any lone pairs of electrons that influence the shape.

Name the shape.

Shape

Name of shape \_\_\_\_\_

(2)

- (c) Suggest why the oxidation state of chromium is zero in  $\text{Cr}(\text{PF}_3)_6$

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(1)

The compound  $[\text{Cr}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}$  contains ammonia molecules.

- (d) Deduce the oxidation state of chromium in  $[\text{Cr}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}$

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(1)

- (e) Name the type of bond between N and H in ammonia.

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(1)

- (f) The compound  $[\text{Cr}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}$  contains a complex ion that shows isomerism.

Draw the two isomers of the complex ion.

State the type of isomerism shown.

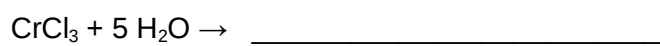
Isomer 1

Isomer 2

Type of isomerism \_\_\_\_\_

(3)

- (g) Complete the equation to show the formation of **one** complex that contains chromium in its +3 oxidation state.



(1)

(Total 10 marks)