TRANSITION METALS (C)

1 Give the full electron configuration of the following atoms and ions.

a Co atom **$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^7$** (1)

b Co^{2+} ion **$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^7$** (1)

2 The complex $[Pt(NH_3)_2Cl_2]$ exists as two stereoisomers.

a What are stereoisomers?

same structural formula but different arrangement of atoms in space (1)

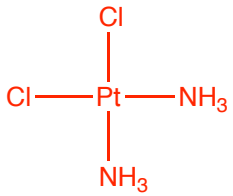
b Draw the cis stereoisomer, name its shape, ligand-Pt-ligand bond angles, give its co-ordination number and oxidation state of the platinum.

Name of shape = **square planar**

ligand-Pt-ligand bond angles = **90°**

Co-ordination number = **4**

Oxidation state of Pt = **+2**



(5)

3 a A complex absorbs visible light at 582 nm. Calculate the energy gap between the d orbitals in J.
[Planck's constant is 6.63 x 10^{-34} Js and the velocity of light is 3.00 x 10^8 ms^{-1}]

$$\Delta E = hf = \frac{hc}{\lambda} = \frac{6.63 \times 10^{-34} \times 3.00 \times 10^{8}}{582 \times 10^{-9}} = 3.42 \times 10^{-19}\ J$$ (3)

b Calculate the energy gap between the d orbitals in kJ mol^{-1}.
[the Avogadro constant (*L*) is 6.022 x 10^{23} mol^{-1}]

$\Delta E = 3.42 \times 10^{-19} \times 6.022 \times 10^{23} = 2.06 \times 10^5\ J\ mol^{-1} = 206\ kJ\ mol^{-1}$ (2)