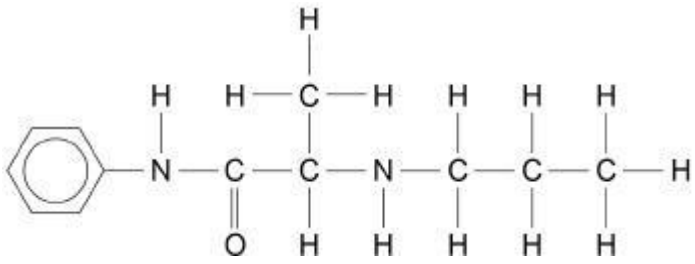
Name of the Student:_____
Max. Marks : 22 Marks **Time : 22 Minutes**

Q1.

Prilocaine is used as an anaesthetic in dentistry.
Figure 1 shows the structure of prilocaine.

Figure 1



(a) Draw a circle around any chiral centre(s) in **Figure 1**.

(1)

(b) Identify the functional group(s) in the prilocaine molecule.

Tick (✓) the box(es) corresponding to the functional group(s).

Amide	Amine	Ester	Ketone

(1)

(c) Prilocaine is completely hydrolysed in the human body to give a mixture of products.

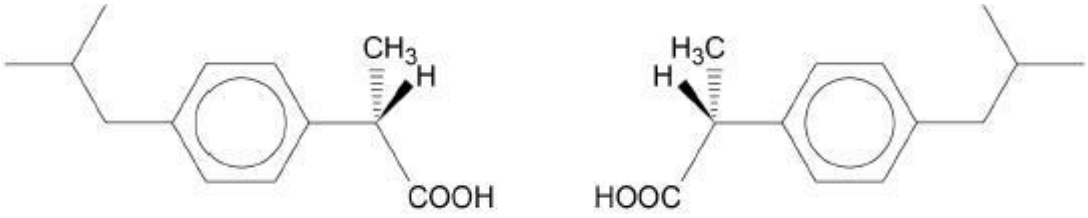
Draw the structures of the two organic products formed in the complete hydrolysis of prilocaine in acidic conditions.

(3)

(d) **Figure 2** shows optical isomers **F** and **G**.

Figure 2

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Isomer **F** is the active compound in the medicine ibuprofen.

In the manufacture of ibuprofen both isomers **F** and **G** are formed. An enzyme is then used to bind to isomer **G** and catalyse its hydrolysis.

After the products of hydrolysis of **G** are removed, a pure sample of isomer **F** is collected.

Explain how a structural feature of this enzyme enables it to catalyse the hydrolysis of isomer **G** but not the hydrolysis of isomer **F**.

_____

_____

_____

_____

(2)

(Total 7 marks)

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Q2.

Cisplatin, $[Pt(NH_3)_2Cl_2]$, is used as an anti-cancer drug.

(a) Cisplatin works by causing the death of rapidly dividing cells.

Name the process that is prevented by cisplatin during cell division.

_____

(1)

After cisplatin enters a cell, one of the chloride ligands is replaced by a water molecule to form a complex ion, **B**.

(b) Give the equation for this reaction.

_____

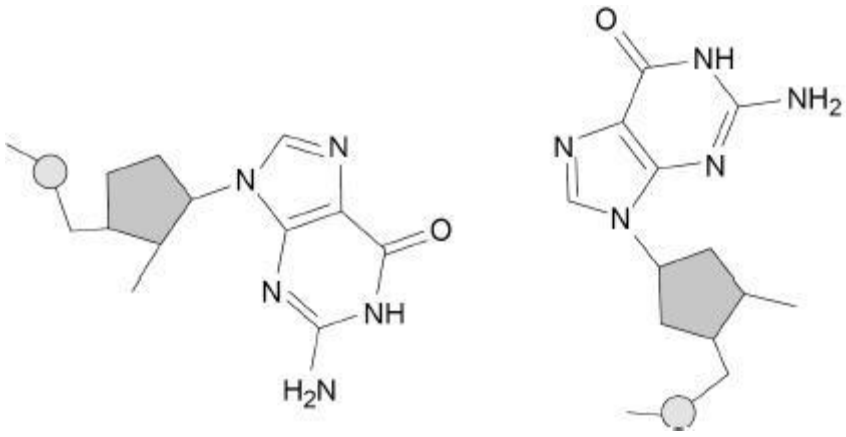
(2)

(c) When the complex ion **B** reacts with DNA, the water molecule is replaced as a bond forms between platinum and a nitrogen atom in a guanine nucleotide.
The remaining chloride ligand is also replaced as a bond forms between platinum and a nitrogen atom in another guanine nucleotide.

Figure 1 represents two adjacent guanine nucleotides in DNA.

Complete **figure 1** to show how the platinum complex forms a cross-link between the guanine nucleotides.

Figure 1



(2)

An experiment is done to investigate the rate of reaction in part (b).

(d) During the experiment the concentration of cisplatin is measured at one-minute intervals.

Explain how graphical methods can be used to process the measured results, to confirm that the reaction is first order.

_____

_____

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(3)

In another experiment, the effect of temperature on the rate of the reaction in part (b) is investigated.

The table shows the results.

Temperature T / K	$\frac{1}{T}$ / K^{-1}	**Rate constant k / s^{-1}**	**ln k**
293	0.00341	1.97×10^{-8}	−17.7
303	0.00330	8.61×10^{-8}	−16.3
313	0.00319	3.43×10^{-7}	−14.9
318		6.63×10^{-7}	
323	0.00310	1.26×10^{-6}	−13.6

(e) Complete the table above.

(2)

(f) The Arrhenius equation can be written in the form

$$\ln k = \frac{-E_a}{RT} + \ln A$$

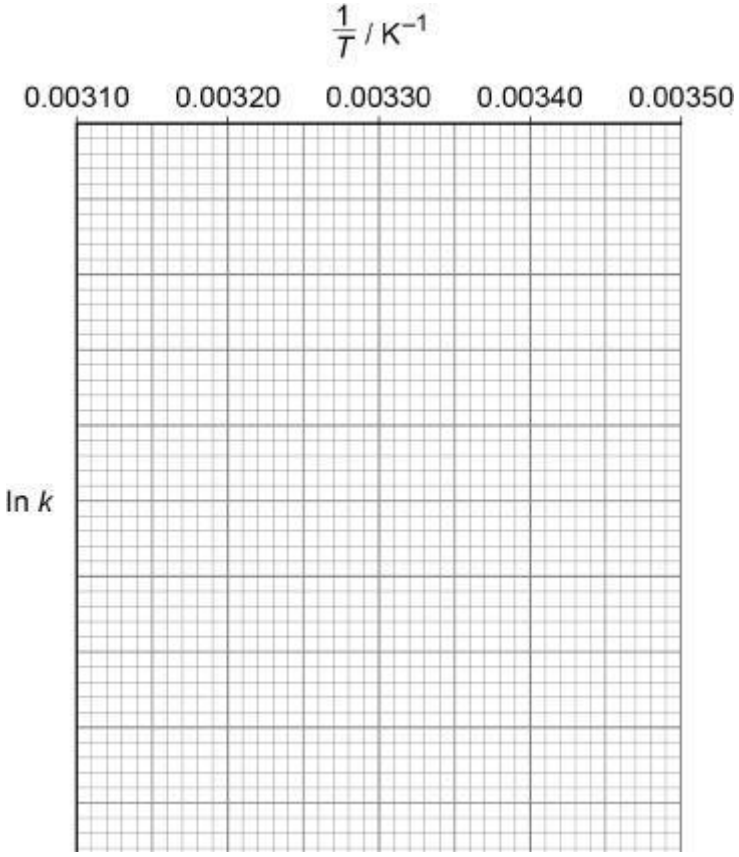
Use the data in the table above to plot a graph of ln k against $\frac{1}{T}$ on the grid in **Figure 2**.

Calculate the activation energy, E_a, in kJ mol^{-1}

The gas constant, R = 8.31 J K^{-1} mol^{-1}

Figure 2

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E_a _____ kJ mol^{-1}

(5)

(Total 15 marks)

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