Question 1. Given the ciphertext EEAIR GGITS GYUEE TDNUW NOAOY RIAAT RHWGR NDVLP CITHN ITAOF KSGIO EATTD OELLB FHTDN AI, and the length of the keyword is 6, use rectangular transposition to find the plaintext and the key. The plaintext contains the word plastic.

Solution. Because the length of the ciphertext is 72, and the length of the keyword is 6, then

$$k = \frac{\text{length of ciphertext}}{\text{length of keyword}} = \frac{72}{6} = 12$$

So we make the ciphertext into 12-grams.

EEAIRGGITSGY UEETDNUWNOAO YRIAATRHWGRN DVLPCITHNITA OFKSGIOEATTD OELLBFHTDNAI

So we have the rectangle given as follows:

$$\begin{bmatrix} E & U & Y & D & O & O \\ E & E & R & V & F & E \\ A & E & I & L & K & L \\ I & T & A & P & S & L \\ R & D & A & C & G & B \\ G & N & T & I & I & F \\ G & U & R & T & O & H \\ I & W & H & H & E & T \\ T & N & W & N & A & D \\ S & O & G & I & T & N \\ G & A & R & T & T & A \\ Y & O & N & A & D & I \end{bmatrix}$$

Because the plaintext contains the word plastic, then we need to rearrange the columns until the word plastic appears.

$$\begin{bmatrix} E & U & Y & D & O & O \\ E & E & R & V & F & E \\ A & E & I & L & K & L \\ I & T & A & P & S & L \\ R & D & A & C & G & B \\ G & N & T & I & I & F \\ G & U & R & T & O & H \\ I & W & H & H & E & T \\ T & N & W & N & A & D \\ S & O & G & I & T & N \\ G & A & R & T & T & A \\ Y & O & N & A & D & I \end{bmatrix} \Rightarrow \begin{bmatrix} D & O & Y & O & U & E \\ V & E & R & F & E & E \\ L & L & I & K & E & A \\ P & L & A & S & T & I \\ C & B & A & G & D & R \\ I & F & T & I & N & G \\ T & H & R & O & U & G \\ H & T & H & E & W & I \\ N & D & W & A & N & T \\ I & N & G & T & O & S \\ T & A & R & T & A & G \\ A & I & N & D & O & Y \end{bmatrix}$$

Therefore, the plaintext is: Do you feel like a plastic bag drifting through the wind wanting to start again with extra letters being doy.

We now need a permutation that satisfies the order in which the rectangular transposition was put in. Observe that the order of the permutation has the form

$$\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 6 & 5 & 3 & 1 & 4 & 2 \end{pmatrix}$$

So the key is 463521, i.e. $(123456) \mapsto (463521)$.