Question #2 on 2018 Sample 6 is a Patristocrat with a <u>K1 alphabet</u> and a simple clue:

2) [300 Points] Solve this Patristocrat which is a quote by Aristotle which is encoded using a K1 key and starts and ends with the word **IT**.

VCVBC UNXQA IKTQJ NODSQ CNOXV JOCKR NQRMN CKNJC

NACQV JQCUK DPUCL VCUKD CQSSN YCVJP VC

<u>K1</u>	A	В	C	D	E	F	G	H	I	J	K	L	M	N	0	P	Q	R	S	T	U	V	W	X	Y	Z
Frequency	2	1	13	3					1	5	5	1	1	8	3	2	7	2	3	1	4	7		2	1	
Replacement																										

## Here's one approach to solving it.

Replacement

1. Since we are given that **VC** corresponds to **IT**, we can go through and make that substitution globally as well as put it in our replacement below

VCVBC	U	N 2	۲Q	Α	I	K	ТQ	J	N	01	D S	Q	(	CN	10	X	V	J	0	CI	(R	2	Nζ	) R	RMN	CK	NJ	ГС
ITI T														Г			Ι			Т						T		T
NACQV	J	Q	CU	K	Γ	P	ŪC	L	V	CI	IJĸ	D	(	CÇ	)S	S	N	Y	C'	V	JΡ	•	V (	2				
TI		7	ľ		T				I	ΙΤ				T					ΤI					C C				
<b>K</b> 1	A	В	C	D	E	F	G E	Ι	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	$\mathbf{Z}$			
K1 Frequency	<b>A</b> 2	<b>B</b>	<b>C</b> 13	<b>D</b>	E	F	G E	1	<b>J</b>	<b>K</b> 5	<b>L</b>	M 1	<b>N</b>	<b>o</b>	<b>P</b> 2	<b>Q</b> 7	<b>R</b> 2	<b>S</b>	<b>T</b>	<b>U</b> 4	<b>V</b> 7	W	<b>X</b> 2	<b>Y</b>	Z			

2. Next we see that the frequency of **N** is the highest remaining, we are going to guess that it is the letter **E**. even though we have **C** at a very high frequency which we were told what it maps to.

V	CVE	зС	UI	ΚN	ζQ	Α	I	K	T	Q	J	N	OI	<b>D</b> S	S Q	. (	CN	10	X	V	J	0	CE	KR	2	Nζ	2 R	RΜ	N	C	ΚN	JC	
I?	C I	T	1	E								E				•	ΓE	:		Ι		- 1	Т			E			E	Т	E	Т	
N Z	4C Ç	γ	J	QC	U	K	Γ	P	U	C]	L	V	Cτ	IJF	(D	(	CÇ	)S	S	N	Y	C	Λſ	JΡ	•	V (	C						
E	T	I		7						Т		I	Т				Г			E		Т	Ι			I?	ľ						
	<b>K</b> 1		A	B	C	D	E	F	G	H	I	J	K	L	M	N	0	P	Q	R	S	T	U	V	W	X	Y	Z					
Fı	reque	ency	2	1	13	3					1	5	5	1	1	8	3	2	7	2	3	1	4	7		2	1						

E

3. Looking at the start, we see **IT I?** and can't help but think that it says "IT IS" so we go ahead and fill that in. This also shows us a **ST** corresponding to **BC** which gives us a little confidence in the choice. We also can see that there are too many letters between the **E** and **I** tells us the **E** must be part of a key phrase.

VCVBC UNXQA IKTQJ NODSQ CNOXV JOCKR NORMN CKNJC E E ΤE Т E т ITIST I E E VCUKD CQSSN YCVJP VC NACQV JQCUK DPUCL ΤI Т Т ΙT ΙT E ABCDEFGHIJKLMNOPQRSTUVWXYZ **K**1 1 | 13 | 3 1 5 5 1 8 3 2 **Frequency** 1 7 2 3 7 4  $S \mid T$ Replacement E Ι

4. Since we think that I is probably not part of the key phrase, it is a good bet that **U** corresponds to either a **G** or an **H**. Looking at the start of our phrase, Trying an **H** for the **U** makes the phrase start out as **IT IS THE** giving us another boost of confidence.

UNXOA IKTOJ NODSO CNOXV JOCKR NORMN CKNJC E E ΗE ΤE Ι Т ITIST CQSSN DPUCL **VC** NACQV JQCUK VCUKD YCVJP ΤH Т I HT ITH Т E ΤI ΙT

**K**1 ABCDEFGHIJKLMNOPORS **Frequency** 1 | 13 | 3 1 5 5 8 3 2 2 4 7 2 1 1 7 1  $S \mid T$ E  $H \mid I$ Replacement

5. Looking at the **HT?ITH** sequence, there are very few words that have **ITH** in them with the most obvious being **WITH** so we will take a guess that **L** stands for **W**. This is reasonable since W is a very low frequency letter and there is only a single occurrence of **L** in the text. We can also be certain that it is part of the keyphrase.

UNXQA VCVBC IKTQJ NODSQ CNOXV JOCKR NQRMN CKNJC TE ITIST ΗE E Т Ε Т Ι E E NACQV JQCUK DPUCL VCUKD COSSN YCVJP VC TH HTW ITH E ΤI ΙT

**K1** ABCDEFGHIJKLMNOPQRS 2 2 | 1 | 13 | 3 1 5 5 1 8 3 7 2 3 **Frequency** 1 1 4 7 2  $S \mid T$  $H \mid I$ Replacement

6. Remembering that W has been taken now, we make a quick count of the letters after the ST we notice that **UVXYZ** fills in for **DEFGH** and given that **EFGH** are not used, **VXYZ** not appearing in the quote is logical. So we will guess that **D** stands for **U** and it also tells us our keyphrase probably starts at **I**.

IKTQJ NODSQ CNOXV VCVBC UNXOA CKNJC JOCKR NQRMN ΗE E U ΤE Ι Т E E т E DPUCL VCUKD JQCUK CQSSN NACQV YCVJP VC TH HTW ITH Т U U E ΤI IT Ι **K**1 A B C D E F G H I J K L M N O P Q R S T U V W X Y Z 5 5 2 7 2 1 | 13 | 3 8 3 3 2 Frequency 4  $S \mid T$ |U|V|X|Y

7. Now we take a quick check of our six most frequent letters ETAOIN, we only need to see where A O and N might be used. For this, J K and Q stand out for their higher frequency.

Η Ι

IKTQJ NODSQ CNOXV VCVBC UNXOA JOCKR NORMN CKNJC T aon HE E U ΤE E aon ITIST Ι T.E NACQV JQCUK DPUCL VCUKD CQSSN YCVJP VC T I aon TH ITH IT HTW E

**K**1 ABCDEFGHIJ K L M N O P Q R S T U V W X Y Z 2 | 1 | 13 | 3 8 5 5 2 1 1 1 3 2 7 3 1 7 2 **Frequency** 4 1  $S \mid T$ Η Replacement  $|\mathbf{U}|\mathbf{V}|\mathbf{X}|\mathbf{Y}$ 

Replacement

8. Looking at this, **WITHaonUT** tells us the K must be O. WNow we take a quick check of our six most frequent letters ETAOIN, we only need to see where A O and N might be used. For this, J K and O stand out for their higher frequency.

VCVBC UNXOA IKTOJ NODSO CNOXV JOCKR NORMN CKNJC E an ITIST HE ΤE TO TOE an T U I DPUCL VCUKD CQSSN YCVJP NACOV JQCUK VC T I an ΙT an an THO E T<sub>an</sub> I

**K**1 A B C D E F G H I J K L M N O P Q R S T U V W X Y Z 8 3 2 **Frequency** 2 | 1 | 13 | 3 1 | 5 | 5 | 1 | 1 7 2 3 4 7 2 1  $S \mid T$ Replacement U|V|X|YZ  $H \mid I$ 

9. **THOU?HT** can only be **THOUGHT** which tells us the **P** must stand for **G**. It also tells us that the keyphrase must extend to the letter **P**.

VCVBC UNXQA IKTQJ NODSQ CNOXV JOCKR NORMN CKNJC ITIST HE TE TO TOE an T U I E an COSSN NACQV JQCUK DPUCL VCUKD YCVJP VC THO UGHTW E TI an G

**K1** A B C D E F G H I J K L M N O P Q R S T U V W X Y Z 13 3 5 2 Frequency 5 1 8 3 7 2 3 7 2 1 4 1 1 S T $|\mathbf{U}|\mathbf{V}|\mathbf{X}|\mathbf{Y}|$  $H \mid I$ Replacement Z  $\mathbf{O}|\mathbf{W}$ G an

10. This gives us a really nice breakthrough as it tells us that **J** must be **N** (and **Q** is **A**) by looking at the **WITHOUT** an??**E**?**TIaonG IT**. It wouldn't make sense to for **J** to be **A** which would read as **WITHOUT N**??**E**?**TIAG IT**. Filling that in gives us:

UNXOA IKTOJ NODSQ JOCKR NORMN CKNJC CNOXV IST ΗE A AN E U Α ΤE Ι N TO ΕA TOENT JOCUK DPUCL VCUKD CQSSN NACQV YCVJP VC TA TAI NATHO UGHTW ITHOU E TING

**K**1 J K L M N O P Q R S 8 3 1 | 13 | 3 5 5 1 2 2 **Frequency** 1 1 7 1 4 7 2 1 S T|U|V|X $H \mid I$ Replacement  $\mathbf{O}$ G

11. Stepping back in to the K1 alphabet, we see that there is only one letter gap in the Q-U mapping for A-H and a two letter gap in the V-B range for I-S. So we fill out those letters and look to see what that gives us.

VCVBC UNXQA IKTQJ NODSQ CNOXV JOCKR NQRMN CKNJC ITIST HE A OdfAN E UcdA TE EA<sub>bc</sub> TOENT TO<sub>bc</sub> JQCUK DPUCL CQSSN VCUKD NACQV YCVJP VC NATHO UGHTW TAI

A B C D E F G H I J K L M N O P Q R S T U V W X Y **K**1 1 | 13 | 3 5 5 1 8 3 2 7 3 2 Frequency 1 1 Replacement pqr  $S \mid T$ U V|X|Y

12. Reading through what this gives us, you can immediately see that **AcdcdElmpTING** must be **ACCEPTING** which means that **S** must be **C** (forcing **R** to be **B**) and **Y** must be **P** which forces **Z** to be **Q** and **A** to be **R**. Filling just those gives us.

UNXQA IKTQJ NODSQ NQRMN VCVBC JOCKR CKNJC CNOXV OdfAN EAB HE AR UCA TOB JQCUK DPUCL VCUKD COSSN YCVJP VC NACQV UGHTW ITHOU TACCE ERTAI PTING THO ΙT

 K1
 A
 B
 C
 D
 E
 F
 G
 H
 I
 J
 K
 L
 M
 N
 O
 P
 Q
 R
 S
 T
 U
 V
 W
 X
 Y
 Z

 Frequency
 2
 1
 13
 3
 1
 5
 5
 1
 1
 8
 3
 2
 7
 2
 3
 1
 4
 7
 2
 1
 1

 Replacement
 R
 S
 T
 U
 V
 X
 Y
 Z
 N
 O
 W
 E
 G
 A
 B
 C
 df
 H
 I
 jkl
 klm
 P
 Q

13. Next we see **E?UCATE** which tells us that **O** must be **D** (leaving **T** to map to **F**).

VCVBC UNXQA IKTQJ NODSQ CNOXV JOCKR NORMN CKNJC EDUCA OFAN TED NDTOB EAB ITIST ΗE AR JQCUK DPUCL VCUKD CQSSN VC NACOV YCVJP ERTAI

 K1
 A
 B
 C
 D
 E
 F
 G
 H
 I
 J
 K
 L
 M
 N
 O
 P
 Q
 R
 S
 T
 U
 V
 W
 X
 Y
 Z

 Frequency
 2
 1
 13
 3
 I
 I
 5
 5
 1
 1
 8
 3
 2
 7
 2
 3
 1
 4
 7
 2
 1

 Replacement
 R
 S
 T
 U
 V
 X
 Y
 Z
 N
 O
 W
 E
 D
 G
 A
 B
 C
 F
 H
 I
 jkl
 klm
 P
 Q

14. Seeing **OF AN EDUCATED** klm**IND** tells us that **X** must be **M**.

VCVBC UNXQA IKTQJ NODSQ CNOXV JOCKR NORMN CKNJC EDUCA EAB ITIST HEMAR OFAN TEDMI NDTOB JQCUK DPUCL VCUKD CQSSN YCVJP NACQV VC ERTAI NATHO UGHTW ITHOU TACCE PTING ΙT

 15. At this point we could simply stop as we have gotten all but two letters of the solution and it would be counted as correct, but with the K1 alphabet in mind, and only **J K** and **L** to place, it is pretty apparent that the key phrase is **KNOWLEDGE** with **I** for **K** and **M** for **L**. Filling this in gives us a final answer and a complete K1 alphabet:

VCVBC UNXQA IKTQJ NODSQ CNOXV JOCKR NQRMN CKNJC
ITIST HEMAR KOFAN EDUCA TEDMI NDTOB EABLE TOENT
NACQV JQCUK DPUCL VCUKD CQSSN YCVJP VC
ERTAI NATHO UGHTW ITHOU TACCE PTING IT

<b>K</b> 1	A	B	C	D	$\mathbf{E}$	F	$\mathbf{G}$	H	I	J	K	L	$\mathbf{M}$	N	$\mathbf{o}$	P	Q	R	S	T	$\mathbf{U}$	$\mathbf{V}$	$\mathbf{W}$	X	Y	$\mathbf{Z}$
Frequency	2	1	13	3					1	5	5	1	1	8	3	2	7	2	3	1	4	7		2	1	
Replacement	R	S	T	U	V	X	Y	Z	K	N	O	W	L	E	D	G	A	В	C	F	Н	I	J	M	P	Q