

Science Olympiad – Lower Merion

Captains Tryouts 2020

2019

Exam Preparation

You will need:

1. Folders for each of the teams to hold the tests
2. Sufficient copies of the test for all teams. They don't need to be stapled.
3. Multiple timers which have a lap function on them - ideally one per volunteer. The timer app on an iPhone or Android Phone that has a stopwatch function with lap function is sufficient.

Before the event begins:

1. Practice starting the timers and using the lap function to record the times. Make sure volunteers understand how to use the lap function and are not accidentally stopping the timer completely.
2. Memorize the answer to the timed question.
3. Check to make sure that this key matches the test you are proctoring.
4. Place one copy of the test for each team in the provided folders with the first page outside the folder.
5. Adjust desks and chairs – teams may have up to 3 students for this event.

Running the Event

1. When the students enter the room, instruct them to sit down, DO NOT OPEN THE FOLDER, and put their names, school name and school number on the first page.
2. Encourage them to write their team number on all the other pages AFTER they begin the test. This way if their papers gets separated from each other we can make sure to give them credit.
3. **CRITICAL:** Check to see that students have ONLY brought
 - i. Something to write with (pencils, pens, erasers)
 - ii. Five function calculators (addition, subtraction, multiplication, division, and usually square root). The calculator can have a simple memory store/recall function but must not have a modulus or other scientific and programmable functions. If their calculator doesn't meet these requirements, they may not use it.
 - iii. If there are spare calculators in the kit, you may loan up to one per team to use for the test.
 - iv. If the student has a smart watch (Apple watch, Samsung Gear, etc.) they will need to put it away.
4. Instruct the students that if they answer the timed question within 10 minutes, they can be awarded a bonus if they solve the timed question with no more than 2 letters incorrect.
 - i. When they have a solution for the cryptogram they should raise their hand.
 - ii. Let them know that you will announce when the 10-minute time is up. After the first 10 minutes, no additional bonus points will be awarded.
 - iii. When you see a team raise their hand, hit the LAP function and head to the team.
 - iv. Determine if their answer is correct (see next page for grading), If so, write the time on their score sheet.
 - v. If their score is incorrect (more than 2 letters incorrect), tell the team that the answer is wrong, but DO NOT tell them what is wrong. They can continue to work on the question and raise their hand again to be checked. A team has an unlimited number of attempts during the 10-minute bonus.
5. Tell the teams that they do not have to fill in the frequency table. It is simply there as an aid to them solving the cryptogram. It will not be graded.
6. Some students may never have used a non-scientific calculator. You should have them enter a simple formula on their calculator: $1 / 26 = * 26 = ..$ Most will be surprised to see that the answer is not rounded to 1 as they expected but .9999999999
7. When the timers hit the 10-minute point, announce that no bonus points will be awarded and put away the timers. The students may continue to work on the question, but they may not receive any extra points.
8. A team is not restricted to only the timed question during the 10 minutes. They can move on or split up the work if they would like, but it is in their best interest to try for the bonus.

- When time is up, have the students put writing instruments down and put their answer pages back into the folder in the correct order.

How to grade

- Teams can have up to two incorrect letters total on their cryptogram and still be correct. The frequency of the incorrect letter is irrelevant. See the example below.

If the cryptogram was as shown:

KZBAOF KFXMFXYF

SAMPLE SENTENCE

and the students answered (underlined letters indicate mistakes)

SAMPLE SENTENCE

then it counts as four mistakes (even though the mistake was only in the letter E) and the answer DOES NOT count. However, if they put

SAMPUL SENTENCE

It is considered correct with two letter mistakes.

- For questions which have a numeric answer (such as determining the a= and b= values), no mistakes are allowed.
- Teams do NOT have to fill in the frequency table. It is simply there as an aid to them solving the cryptogram. It WILL NOT be graded. It is included in the answer key as an aid to the grader.
- When scoring the Baconian ciphers (with strange text or symbols), they can write the answer under the Baconian symbols or on the line provided. Note that you will see lots of As and Bs, but they are not graded as the answer, only what they put on the answer line.
- As you score each question, if correct, put the number of incorrect letters (0, 1, or 2) next to the question number on the scoring page. Also, put the value for the question into the score column. If they get more than 2 letters wrong, subtract 100 points from the score until it would be zero. If a question is worth 240 points and they get 4 letters wrong, you would start with 240 points (for up to 2 letters wrong) and then subtract 100 points for the next two letters wrong ending up with a final score of 40 points for that question. If they had gotten 5 or more letters wrong on a 240 point question, they would receive 0 points for that question. With a 650 point question, they could get 8 letters wrong and receive 50 points (2 free letters then $6 \times 100 = 600$ points off). Just put the incorrect cost deduction on the score sheet and subtract it from the value for the question. Under no circumstance should the score for any question be less than zero. Note that while the timed question must have 2 or fewer letters incorrect in order to get the timing bonus, a team solving the timed question after the 10 minutes passed would be accepted as correct with 3 incorrect letters receiving 100 points for the timed question.
- If they correctly answered the timed question in 10-minutes or less with 2 or fewer letters incorrect, you need to compute the bonus time. Take the value for the minute from this first table below

0:xx	2,160	1:xx	1,920	2:xx	1,680	3:xx	1,440	4:xx	1,200
5:xx	960	6:xx	720	7:xx	480	8:xx	240	9:xx	0

and then add the seconds value from this table:

X:00	240	X:01	236	X:02	232	X:03	228	X:04	224	X:05	220
X:06	216	X:07	212	X:08	208	X:09	204	X:10	200	X:11	196
X:12	192	X:13	188	X:14	184	X:15	180	X:16	176	X:17	172
X:18	168	X:19	164	X:20	160	X:21	156	X:22	152	X:23	148
X:24	144	X:25	140	X:26	136	X:27	132	X:28	128	X:29	124
X:30	120	X:31	116	X:32	112	X:33	108	X:34	104	X:35	100
X:36	96	X:37	92	X:38	88	X:39	84	X:40	80	X:41	76
X:42	72	X:43	68	X:44	64	X:45	60	X:46	56	X:47	52
X:48	48	X:49	44	X:50	40	X:51	36	X:52	32	X:53	28
X:54	24	X:55	20	X:56	16	X:57	12	X:58	8	X:59	4

For example if they solved the time question at the 6:46 mark, you would add 720 (from the 6:xx entry in the first table) to 56 (from the X:46 entry in the second table) to get a bonus of 776. If they had solved it in exactly 4:00 minutes, you would add 1200 and 240 to get a bonus of 1440.

- Add up all the scores and put the total on the bottom of score sheet.

8. You must break all ties. Indicate the tie breaker by adding .1 to the score of the team ahead. With multiple teams tied, you will add more. I.e. if five teams all scored 200 points, the final scores that you would enter on the score sheet would be 200.4, 200.3, 200.2, 200.1 and 200.
9. To determine how to break the tie, you need to look at the correctly answered questions in the order from the table below. If both teams answered the same (i.e. they answered the question with zero mistakes) then you go on to the next question. If one team had no mistakes and the other team had one mistake, then the team with no mistakes is ahead. For example, if one team answered question #8 (which is the highest value question) and another team didn't, the first team will be ahead.

Tie Breaker Order	Question #
1	2
2	18
3	13
4	12
5	17
6	20
7	16
8	8
9	6
10	1
11	14
12	3
13	19
14	10
15	15
16	9
17	4
18	Timed
19	11
20	7
21	5

0. If there is still a tie (typically when you have teams which answered either zero, one or two questions) then you will need to look at the tie breaker questions again and count the number of correctly answered letters. The team with the most correctly matched letters is to be ahead.

Timed Question [250 points] Solve this quote from Randy Pausch. When you have solved it, raise your hand so that the time can be recorded and the solution checked.

U IN TRUCT JR FXXM AIBUCT VZC XBXSH YIH U AIBX GXVJ,
 I AM GOING TO KEEP HAVING FUN EVERY DAY I HAVE LEFT,

EXWIZLX JAXSX UL CR RJAXS OIH RV GUVX. HRZ QZLJ AIBX
 BECAUSE THERE IS NO OTHER WAY OF LIFE. YOU JUST HAVE

JR YXWUYX OAXJAXS HRZ ISX I JUTTXS RS IC XXHRSX.
 TO DECIDE WHETHER YOU ARE A TIGGER OR AN EEYORE.

	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	7	4	5		1	1	2	6	10	8		3	1	1	2		1	10	8	5	8	4	2	22	3	5
Replacement	H	V	N	X	B	K	L	Y	A	T	Z	S	P	M	W	Q	J	O	R	G	I	F	C	E	D	U

1) [400 points] Decrypt the following message. It has been encoded in Hill with a keyword of TART.

$$\begin{pmatrix} T & A \\ R & T \end{pmatrix} \equiv \begin{pmatrix} 19 & 0 \\ 17 & 19 \end{pmatrix}$$

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

2) [700 points] Solve this Patristocrat by Roger de Rabutin de Bussy.

HLQMB RMAQU WPWZM HQTAB YAQUW NAOMA UMJUA BEGAQ
 ABSEN CEIST OLOVE ASWIN DISTO FIREI TEXTI NGUIS

SMQUS MQIHP PHBYM BDABY PMQUS MEOMH U
 HESTH ESMAL LANDE NKIND LESTH EGREA T

Absence is to love as wind is to fire; it extinguishes the small and enkindles the great.

	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	8	6		1	2		1	5	1	1		1	11	1	2	4	8	1	3	1	7		3		3	1
Replacement	I	N	P	K	G	Z	U	A	M	X	Q	B	E	F	R	L	S	C	H	W	T	Y	O	J	D	V

3) [350 points] Solve this quote by Amy Sedaris.

J ZUJOE JZ 'M CSSR KSH I DAHMSO ZS MDAOR ZJFA IBSOA.
 I THINK IT'S GOOD FOR A PERSON TO SPEND TIME ALONE.

JZ CJWAM ZUAF IO SDDSHZVOJZX ZS RJMQSWAH LUS ZUAX
 IT GIVES THEM AN OPPORTUNITY TO DISCOVER WHO THEY

IHA IOR ZS KJCVHA SVZ LUX ZUAX IHA IBLIXM IBSOA.
 ARE AND TO FIGURE OUT WHY THEY ARE ALWAYS ALONE.

	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	13	3	3	4	1	2		7	9	9	2	3	6		8		1	4	14		6	3	2	5		13
Replacement	E	L	G	P	K	M	Z	R	A	I	F	W	S	X	N	B	C	D	O	J	H	U	V	Y	Q	T

4) [250 points] Solve this K2 Aristocrat.

YDAADMECZ JSX FRJS DY AXRIJ HXIEIJRCUX EI MSRJ BRNXI
 FOLLOWING THE PATH OF LEAST RESISTANCE IS WHAT MAKES

TDJS BXC RCW HELXHI UHDDNXW.
 BOTH MEN AND RIVERS CROOKED.

Replacement	R	T	U	W	X	Y	Z	S	E	V	N	A	B	C	D	F	G	H	I	J	K	L	M	O	P	Q
K2	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	3	2	4	6	4	1		4	6	6		1	2	2			6	4	1	2		2	8	2	1	

5) [150 points] Solve this Caesar Cipher.

G	V	F	G	V	I	R	I	V	C	P	J	L	T	T	V	V	U	L	E	C	V	J	J	K	Y	V	P	Y	R	M	V	
P	E	O	P	L	E	R	A	R	E	L	Y	S	U	C	C	E	E	D	U	N	L	E	S	S	T	H	E	Y	H	A	V	E

W	L	E	Z	E	N	Y	R	K	K	Y	V	P	R	I	V	U	F	Z	E	X	.
F	U	N	I	N	W	H	A	T	T	H	E	Y	A	R	E	D	O	I	N	G	.

6) [400 points] Solve this aristocrat.

EUTZKQ YWK ZB U MEFZMJ. IEJXJ ZB JKFWQE YWK YFX JUME
 HAVING FUN IS A CHOICE. THERE IS ENOUGH FUN FOR EACH

FY WB. MEFFBZKQ IF EUTJ YWK OJRJKOB FK VFW FKHV.
 OF US. CHOOSING TO HAVE FUN DEPENDS ON YOU ONLY.

	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		5			7	10		1	2	8	9		4		2		3	1		2	4	2	6	2	5	5
Replacement	X	S	M	B	H	O	W	L	T	E	N	Q	C	J	D	K	G	P	Z	V	A	Y	U	R	F	I

7) [200 points] Decode the following Baconian cipher.

BELOW EARTH A KISS BOMBS AM BOY BEARD YAHOO BASIC
 BABAA AABBB AAAAA BAABA AABAA BAABB AABAA BAAAA
 W H A T E U/V E R

BANJO UNDER POINT YACHT STRIP MIGHT OFFER CREEK BOOTY
 BABBA ABBAB BAABB AAABB ABBAB AAABB ABBAB ABAAA BAABA
 Y O U/V D O D O I/J T

FATSO ASHES GRAVY AN APE
 BABAA AABAA ABABA ABABA
 W E L L

Whatever you do, do it well.

8) [400 points] The following quote needs to be decoded with the Affine Cipher where $a=7$ and $b=15$.

T	C	P	O	O	J	Y	O	T	G	T	C	F	M	P	G	R	V	Z	D	M	Y	Z	C	P	C	K
I	N	A	L	L	O	F	L	I	V	I	N	G	H	A	V	E	M	U	C	H	F	U	N	A	N	D

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

A	Z	L	S	R	C	K	Z	E	R	K
J	U	S	T	E	N	D	U	R	E	D

9) [250 points] The following quote needs to be encoded with the Vigenère Cipher with a keyword of ORCHARD

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

10) [300 points] The following quote by Martin Luther King Jr. needs to be encoded with the Affine Cipher using $a=15$ and $b=7$.

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

11) [200 points] The following quote by Benedict Cumberbatch needs to be decoded with the Vigenère Cipher with a keyword of PENGUIN

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

12) [550 points] Solve this Patristocrat that has been encoded with a K1 cipher.

USJAF DMZAO PNGUZ TSFZU LAZOR NDMHP NOJAF DMLAU
 IFYOU RENOT HAVIN GFUNI DONTC AREWH ATYOU REDOI

ZTLAZ OLAUO YAGMA ZSUZL EAYMO PUZTM XEMXU SMEOA
 NGDON TDOIT MOVEO NFIND SOMET HINGE LSELI FESTO

AEPAD O
 OSHOR T

If you're not having fun - I don't care what you're doing - don't do it. Move on. Find something else, life's too short.

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	13			4	4	3	2	1		2		5	8	3	8	4		1	4	3	8			2	2	9
Replacement	O	P	Q	R	S	U	V	W	X	Y	Z	D	E	A	T	H	B	C	F	G	I	J	K	L	M	N

13) [550 points] A quote has been encoded using the Pollux Cipher for you to decode. You are told that 1=●, 2=--, 5=x, 6=●, 8=x, 9=--

22512521251551255212152225225225115252251521525525222
 --x●-x●-x●xx●-xx●-●x---x--x--x●●x-x--x●x-●x-xx-x---
M A K E A C O M M I T M E N T T O

5511151251112511521522155112151125215511151515521225222
 xx●●●●x●-x●●●-x●●x-●x--●xx●-●x●●-x-●xx●●●●x●xx-●--x---
H A V I N G F U N S E E Y O

5112512155211151511152551121512151151521521151115512521
 x●●-x●-●xx-●●●x●x●●x-xx●●-●x●-●x●●x●x-●x-●●x●●●xx●-x●-
U R B E S T F R I E N D S A N

52115522512521251552511522515511215222512155212252225112
 x-●●xx--x●-x-●-x●xx-x●●x--x●xx●●-●x---x●-●xx-●--x---x●●-
D M A K E T I M E F O R Y O U

51215511115222521115211151151511155125215211551221512
 x●-●xx●●●●x---x-●●●x-●●●x●●x●●●●xx●-x-●x-●●xx●--●x●-
R H O B B I E S A N D P A

5111511151152225215111
 x●●●x●●●x●●x---x-●x●●●
S S I O N S

14) [350 points] Solve this quote by Justin Timberlake.

**OKT STAO LRIO RSFNO STCJU RYFJT CA OKRO VFN ITRYV
 THE BEST PART ABOUT BEING ALONE IS THAT YOU REALLY**

**HFJ'O KRZT OF RJAQTI OF RJVSFHV. VFN HF QKRO VFN
 DON'T HAVE TO ANSWER TO ANYBODY. YOU DO WHAT YOU**

**QRJO.
 WANT.**

	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	3		2		10		3	3	6	4	1		4	11		3	10	4	7	1	6			3	1	
Replacement	S	M	I	F	J	O	Z	D	R	N	H	P	C	U	T	X	W	A	B	E	G	Y	Q	K	L	V

15) [250 points] Decode the following message in Baconian.

,./, .?, ./< .?<>/, >/, .?, ./, ./< ./< ./< /<>/< .?, ./, >?, .?, .
AAAAABAAABABBBAABAAABAAAAABAABAABAABBABABAAAABBAABAA
A S P I R E T O I N S

/< .?<>/, >/, .?, ./, ./< ./, ./, >/, >/, ./< .?, >?, >?, ./, ./< ./<
ABABBBAABAAABAAAAABAABAAAAABABABBABBAAAAAABAAB
P I R E B E F O R E

.?, ./, >/, ./< ./< .?, >/<>?, .?, ./< ./, ./, >/,
ABAAAABAAAABAABABABABBBAABAAAABAAAAABAA
W E E X P I R E

Aspire to inspire before we expire.

16) [400 points] Solve the following Spanish aristocrat.

YEDTRL RGWGDW DBNL, ILRL GB ETJXGMWL YLTWSJMD SDMD
CUANDO DESEAS ALGO, TODO EL UNIVERSO CONSPIRA PARA

HEG MGDBJYGW IEW WEGCLW.
QUE REALICES TUS SUEÑOS.

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

Translation: *When you want something, the whole universe conspires to make your wish come true.*

17) [500 points] A quote has been encoded using the Morbit Cipher for you to decode. You are told that 2=●●, 4=●- , 6=●x, 7=x●, 8=-●

2 6 1 3 1 7 9 7 6 1 7 7 2 5 3 2 2 7 5 2 6 2 9 3 4 8 7 8 6
 ●●x---x--x●x-x●x--x●x●●xx-x●●●x●xx●●●x●x--x●--x●-●●x
S O M E T I M E S / T H E / S I M P L

6 9 7 2 6 2 9 6 1 6 2 6 7 3 4 6 6 9 3 1 3 4 6 6 7 4 6
 ●xx-x●●●x●x-x-x--x●●●xx-x-x-●xx-x--x--x-●x●xx●-●x
E / T H I N G S / A R E / M O R E / F

2 3 8 5 4 9 6 8 6 9 3 6 4 9 6 2 9 6 1 6 2 8 7 4 7 8 6
 ●●-x-●xx-x-●x-●●xx--x●x-x-●x●x-●x--x●●-●x●-x-●●x
U N / A N D / M E A N I N G F U L

9 7 2 6 4 9 6 7 3 4 2 7 8 6 9 7 2 6 6 9 2 6 4 9 6 1 4
 x-x●●●x-x-●xx-x-●●x-●●xx-x●●●x●xx-●●●x-x-●x--●-
/ T H A N / A L L / T H E / B A N Q

7 4 7 9 7 2 5 2 9 6 9 7 2 6 6 7 1 9 1 7 8 7 8 6 8 6
 x●-x●x-x●●●xx●x-●xx-x●●●x●xx--x--x-●x-●x-●●x-●●x
U E T S / I N / T H E / W O R L D

18) [650 points] Solve this quote from Donald Trump.

**COLWO UDYIL SELUG OYFYI TOPZO CIDQI WTFDI SEULO
 ITRYT OLEAR NFROM THEPA STBUT IALWA YSPLA NFORT**

**VYEZO ZLYPW EUBZT CSNYR BDZTC AYDWU SOVYF LYTYS
 HEFUT UREBY FOCUS INGEX CLUSI VELYO NTHEP RESEN**

**OOVIO TQVYL YOYVE ZSLYI DDWCT
 TTHAT SWHER ETHEF UNREA LLYIS**

I try to learn from the past, but I always plan for the future by focusing exclusively on the present. That's where the fun really is.

	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	1	2	5	7	5	3	1		7			8		1	12	2	2	1	6	7	5	6	5		13	6
Replacement	V	C	I	L	F	P	M	Z	A	D	Q	R	K	G	T	B	W	X	N	S	O	H	Y	J	E	U

19) [300 points] Encode the following quote from Mark Twain with the Hill cipher with a keyword of DOOR.

$$\begin{pmatrix} D & O \\ O & R \end{pmatrix} \equiv \begin{pmatrix} 3 & 14 \\ 14 & 17 \end{pmatrix}$$

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

20) [450 points] Solve the following Spanish aristocrat.

PU TLC FJX FTÑUK NCLC, XJ NDTXOC, XJ OU OCXOU. PU
TE AMO SIN SABER COMO, NI CUANDO, NI DE DONDE. TE

TLC OJKUNPTLUXPU FJX GKCÑSULTF XJ CKWDSSC; TFJ PU
AMO DIRECTAMENTE SIN PROBLEMAS NI ORGULLO; ASI TE

TLC GCKVDU XC FU TLTK OU CPKT LTXUKT: FJXC TFJ OU
AMO PORQUE NO SE AMAR DE OTRA MANERA: SINO ASI DE

UFPU LCOC UX VDU XC FCA XJ UKUF, PTX NUKNT VDU PD
ESTE MODO EN QUE NO SOY NI ERES, TAN CERCA QUE TU

LTXC FCÑKU LJ GUNEC UF LJT, PTX NUKNT VDU FU NJUKKTX
MANO SOBRE MI PECHO ES MIA, TAN CERCA QUE SE CIERRAN

PDF CMCF NCX LJ FDUXC.
TUS OJOS CON MI SUENO.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	Ñ	O	P	Q	R	S	T	U	V	W	X	Y	Z
Frequency	1		25	9	1	17	3			14	14	13	1	10	3	8	11			3	21	31	4	1	20		
Replacement	Y	Z	O	U	H	S	P	V	X	I	R	M	J	C	B	D	T	W	Ñ	L	A	E	Q	G	N	F	K