

# Science Olympiad — Captains Tryouts

## 2019 - Parkland High School

### 2019

Names of participants: (Please print neatly)

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School Name: \_\_\_\_\_

Check your team:  Varsity  JV1  JV2  JV3

**Warning:** Do not open this packet until given permission to do so.

**Note:** There are useful notes after this page.

**Scoring:**

Time to solve first problem: \_\_\_\_\_ (use to calculate Bonus below)

Question	Value	Incorrect letters	Deduction	Score
Timed	200			
1	275			
2	125			
3	215			
4	200			
5	325			
6	300			
7	375			
8	175			
9	150			
10	450			
11	200			
12	200			
13	275			
14	200			
15	275			
16	600			
17	275			
18	100			
19	375			
20	515			
<b>Bonus</b>				
<b>Final Score</b>				



The following tables might be useful during the event.

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

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
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

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

1	3	5	7	9	11	15	17	19	21	23	25
1	9	21	15	3	19	7	23	11	5	17	25

<b>AAAAA</b>	A	<b>AABBA</b>	G	<b>ABBAA</b>	N	<b>BAABA</b>	T
<b>AAAAB</b>	B	<b>AABBB</b>	H	<b>ABBAB</b>	O	<b>BAABB</b>	U/V
<b>AAABA</b>	C	<b>ABAAA</b>	I/J	<b>ABBBA</b>	P	<b>BABAA</b>	W
<b>AAABB</b>	D	<b>ABAAB</b>	K	<b>ABBBB</b>	Q	<b>BABAB</b>	X
<b>AABAA</b>	E	<b>ABABA</b>	L	<b>BAAAA</b>	R	<b>BABBA</b>	Y
<b>AABAB</b>	F	<b>ABABB</b>	M	<b>BAAAB</b>	S	<b>BABBB</b>	Z

## Frequency Table of English letters:

E - 12.51%	S - 6.54%	C - 3.06%	G - 1.96%	K - 0.67%
T - 9.25%	R - 6.12%	U - 2.71%	W - 1.92%	X - 0.19%
A - 8.04%	H - 5.49%	M - 2.53%	Y - 1.73%	J - 0.16%
O - 7.60%	L - 4.14%	F - 2.30%	B - 1.54%	Q - 0.11%
I - 7.26%	D - 3.99%	P - 2.00%	V - 0.99%	Z - 0.09%
N - 7.09%				

## Frequency Table of Spanish letters:

E - 14.08%	I - 5.98%	M - 3.08%	Y - 1.09%	Z - 0.47%
A - 12.16%	L - 5.24%	P - 2.89%	V - 1.05%	Ñ - 0.17%
O - 9.20%	D - 4.67%	B - 1.49%	G - 1.00%	X - 0.14%
S - 7.20%	T - 4.60%	H - 1.18%	F - 0.69%	K - 0.11%
N - 6.83%	U - 4.69%	Q - 1.11%	J - 0.52%	W - 0.04%
R - 6.41%	C - 3.87%			

For the purposes of cryptograms it is customary to treat n and ñ as distinct letters, but a and á are the same letter. Likewise for e and é, and i and í. In other words, all the accent marks get amputated when working with cryptograms. Also, while some older Spanish dictionaries consider ch, ll, and rr, to be their own letters—this has fallen out of modern usage. Accordingly, “burro” is considered as five letters: “b-u-r-r-o” and not as four letters “b-u-rr-o.”

## Morse Code:

A •-	F ••-	K -•-	P •--•	U ••-			
B -•••	G --•	L •-••	Q --•-	V •••-			
C -•-•	H ••••	M --	R •-•	W •--			
D -••	I ••	N -•	S •••	X -••-			
E •	J •---	O ---	T -	Y -•---			
				Z ---••			
0 -----	2 ••---	4 ••••-	6 -••••	8 ---••			
1 •-----	3 •••---	5 •••••	7 --•••	9 -----•			
• E	- T	-• N	-- M	-•• D	-•- K	-•- G	--- O
•• I	•- A	•-• R	•-- W	•--• P	•--- J		
••• S	••- U	••-• F	•-•• L	--•• Z	--•- Q		
•••• H	•••- V	-•-• C	-•-- Y	••••- 4			
-••• B	-••- X	••--- 2	•••-- 3	----• 9			
----- 0	•---- 1	--••• 7	---•• 8				
••••• 5	-•••• 6						

Timed Question **[200 points]** Solve this Aristocrat, a quote said by Cookie Monster. When you have solved it, raise your hand so that the time can be recorded and the solution checked.

**BCSGO WR ZNAA ANDR NE BUR WCWREB, QEARTT NB 'T**

**QEYARGTGEB, NE ZUNKU KGTR N ZNAA RGB G KCCLNR!**

	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
<b>Frequency</b>	7	6	4	1	6		6				3	1		9	1		2	9	1	5	3		3		1	3
<b>Replacement</b>																										

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1) [275 points] Solve this Aristocrat, a quote by David Alan Grier pertaining to body image.

**GFEU MNAG V PRVDI V XFFI IVDM FW TZPU, QZP FPRUJ**

**MNAG V PJA PF NYFVM PRU EVJJFJ.**

	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	2	8	3		3	5			4	3		7	1	3		1	4	7	1	1	1	2
Replacement																										

2) [125 points] Decode this quote by Walt Disney which has been encoded using an unknown shift of the Caesar cipher.

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

3) [215 points] Decode this affine, which is a punny quote from the children's TV show *Bubble Guppies*. The first two letters are IM.

Z	P	V	N	E	T	B	I	J	L	X	V	T	F	V	J	N	E	Z	X	G	.	K	V	E	Z	,	Y	Y	
																						.							

  

N	I	T	M	J	Z	E	A	X	W	Y	T	E	J	W	.
															.

4) [200 points] Encode this quote by Rumi using the Vigenère cipher and using the keyword, WORDS.

R	A	I	S	E	Y	O	U	R	W	O	R	D	S	N	O	T	V	O	I	C	E	I	T	I	S	R	A	I	N	T	H	A	T	G	

  

R	O	W	S	F	L	O	W	E	R	S	N	O	T	T	H	U	N	D	E	R







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9) **[150 points]** A quote adapted from a famous saying by Benjamin Franklin, has been encoded using the Morbit Cipher for you to decode. You are told that 9=●x, 2=-●, 1=-x, 8=—, 3=x●, 7=●●

9 5 3 2 3 2 9 2 8 6 1 8 1 4 7 9 9 2 9 3 3 1 5 9 5 7 4 5 1 4

4 8 6 5 1 5 4 5 3 6 8 3 1 2 1 9 7 9 3 1 3 2 9 5 4 7 4 5 1 3 7

4 1 5 3 2 4 6 5 2 3 2 3 4 4 4 5 1 3 1 2 4 7 6 8 9 5 9 9 5 4

10) **[450 points]** Solve this patristocrat, which is a quote by Maya Angelou which has been encoded using a K1 Alphabet.

UTJZF SZOEX UWQDZ YQEMU OPLMN OPQUE UTJZF LNOEL

MNOPQ UELMN OPQJZ FCNEE UEFSQ

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			1	1	8	4				3		4	4	5	6	4	6		2	2	7		1	1	1	5
Replacement																										

11) **[200 points]** The following quote by Shakespeare has been encoded with the Vigenère Cipher using a very common word for the key. The 21st through 24th cipher characters (**HEGM**) decode to be **OWNO**

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

12) **[200 points]** Special Agent, Samantha, has the following RSA public key:

$$n = 132823 \quad e = 46501$$

Unfortunately for them, A quantum computer has successfully factored their  $n$

$$132823 = 317 * 419$$

Compute the value of their private key:

Enter the computed private key:

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13) [275 points] Encode the word **animation** below using the keyword TYPEWRITE.

$$\begin{pmatrix} T & Y & P \\ E & W & R \\ I & T & E \end{pmatrix} \equiv \begin{pmatrix} 19 & 24 & 15 \\ 4 & 22 & 17 \\ 8 & 19 & 4 \end{pmatrix}$$

A	N	I	M	A	T	I	O	N

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14) [200 points] A quote from *The Hunger Games* has been encoded using the Pollux Cipher for you to decode. You are told that the quote has **THEB** in it corresponding to the encoded text 2212787828221.

7722033210920322122300270208212202900228938200927732722127878

2822177829912031922309273212387822123733272208382707282812937

15) [275 points] Solve this aristocrat quote by Audrey Hepburn. As a hint, X=S

CEW ABNPGOCPH BDBX, HEEF NG GLB VEEU OQ EGLBW $X$ ; CEW

ABNPGOCPH HOM $X$ , XMBNF EQHD REWUX EC FOQUQB $X$ ; NQU

CEW MEOXB, RNHF ROGL GLB FQERHBUVB GLNG DEP NWB

QBKBW NHEQB.

	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	16	6	3	15	5	9	8			1	5	3	9	7	5	8	4			5	2	7	8		
Replacement																										

16) [600 points] Solve this patristocrat, a quote by Barack Obama. A hint to get you started is G=I.

GSGDO KLSQT OKLAC FARIT FVUTD DFSQT FVSSQ TZKDS

RGMTV DTFAR TRLYF STRCT ATVFS GKAGA KLVQG DSKVO

JQKSQ TAFSG KAGDJ FGSGA CSKIK UUKJ

	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	9		3	7		9	10		2	3	11	4	1		3		6	5	13	12	3	6			1	1
Replacement																										

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17) [275 points] Solve this baconian, a quote said by Bubbles from the old show, *The Powerpuff Girls*.

@\$%& @#%\* (@#%\* @\$^& (@#%\*) @\$%\*) !\$^\* (!\$^\* @\$%& !\$^\*) @\$^\*) @\$  
^& @#^\*) @#%\* (!\$^& (!\$^\* (!\$^\* (@#^\*) !\$^\*) !\$%&) @#%\* (!\$^& @\$^\*  
) !\$^\*) @\$%\*) @\$^\* (@\$%\*) @#^\*) @#%\*) @\$%& !\$^\* (@#^&) @#%\* (!\$%\*) @  
#^& !\$%&) @\$^& (@#^\*) @\$%&) @\$%\*) !\$^\* (!\$^&) @\$%\*) @\$^& (!\$%\*) @\$%  
\*) @#%\*) @\$%\*) @\$^& (!\$^&) @#%\* (@\$%&) @\$%\*) !\$^& !\$%&) @#%\* (  
!\$^& (!\$^&) @#%\* (@\$^\*) @\$%& (@#%\* (!\$^\* (@#%&) @#^\*) !\$^&) @\$^\*) @#  
^&)

18) [100 points] Emma and Andrew want to communicate with each other using RSA for encryption. Emma generates RSA keys obtaining the following values:

$$n = 55665229 \quad e = 29342143$$

$$q = 8209 \quad d = 27256447$$

$$\phi = 55650240 \quad p = 6781$$

Likewise, Andrew also generates RSA keys resulting in the values

$$p = 5197 \quad q = 7717$$

$$n = 40105249 \quad d = 15190219$$

$$\phi = 40092336 \quad e = 10021699$$

They ask each other for the public keys in order to communicate. What information do they each need to transmit in response?

You must also determine what formula Emma needs to calculate in order to decrypt the value 25805 from Andrew

Enter the minimum values that Andrew needs to transmit to Emma:

--	--	--

Enter the minimum values that Emma needs to transmit to Andrew:

--	--	--

Write the formula Emma needs to calculate in order to decrypt the value 25805 from Andrew

19) [375 points] Solve this aristocrat, a quote by Pablo Picasso.

QM KCV IQN JQHVDG QM KCV, CVP QM KCV'J IQN JQHVDG QM

KCV'J. JQHG HG CV HVMRNBCUYM, HVPHGXLJCUYM YCI.

	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	9	2			5	7	3	6	4	1	7	3		2	9	1			2	10		1	3	
Replacement																										

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20) [515 points] Solve this xenocrypt quote by J.K. Rowling, which has been translated into Spanish.

SI HOÑIADZ EI FQL ZEVQHLS SZBL, UHSI EI FQL UL

BISJHLADL LS ULA.

	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	2		2	3	2		4	6	1		9			1	1		3		6		3	1				3
Replacement																											