

Science Olympiad — SLHS Captains

Tryout Exchange

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 .999999999
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.
9. 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

1. 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 KFXMFXYP

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.

2. For questions which have a numeric answer (such as determining the a= and b= values), no mistakes are allowed.
3. 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.
4. 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.
5. 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.
6. 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:12	192
X:18	168
X:24	144
X:30	120
X:36	96
X:42	72
X:48	48
X:54	24

X:07	212
X:13	188
X:19	164
X:25	140
X:31	116
X:37	92
X:43	68
X:49	44
X:55	20

X:08	208
X:14	184
X:20	160
X:26	136
X:32	112
X:38	88
X:44	64
X:50	40
X:56	16

X:09	204
X:15	180
X:21	156
X:27	132
X:33	108
X:39	84
X:45	60
X:51	36
X:57	12

X:10	200
X:16	176
X:22	152
X:28	128
X:34	104
X:40	80
X:46	56
X:52	32
X:58	8

X:11	196
X:17	172
X:23	148
X:29	124
X:35	100
X:41	76
X:47	52
X:53	28
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.
- 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.
- 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	13
2	1
3	21
4	17
5	22
6	20
7	15
8	3
9	12
10	7
11	2
12	Timed
13	19
14	18
15	8
16	11
17	4
18	16
19	14
20	5
21	10
22	9
23	6

- 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 [350 points] Solve this aristocrat, which is a quote from Andy Dwyer from Parks and Rec. When you have solved it, raise your hand so that the time can be recorded and the solution checked.

OCJK VPNNLPV, PGPVZ KFNP ZUC HUUS CX MK KTP NUUE, F,
 JUST REMEMBER, EVERY TIME YOU LOOK UP AT THE MOON, I,

KUU, AFHH LP HUUSFEW MK M NUUE. EUK KTP JMNP NUUE,
 TOO, WILL BE LOOKING AT A MOON. NOT THE SAME MOON,

ULGFUCJHZ, KTMK' J FN XUJJFLHP.
 OBVIOUSLY, THAT'S IMPOSSIBLE.

	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		4		5	7	2	6		6	10	4	5	8	1	11			2	3	17	3	1	2		3
Replacement	W	Z	U	C	N	I	V	L	Q	S	T	B	A	M	J	E	D	F	K	H	O	R	G	P	X	Y

1) [650 points] Solve this Xenocrypt which is a quote from Cien años de Soledad

JHJ HYKWJC KNCJC, GNDTYU JWL DUCLVU MJ PUDVJVUDJ
AMA MUCHAS COSAS, PORQUE AHI RESIDE LA VERDADERA

QYUDBJ, S TYLUI JHJ HYKWN WJKU HYKWN, S GYUVU MNRDJD
FUERZA, Y QUIEN AMA MUCHO HACE MUCHO, Y PUEDE LOGRAR

HYKWN, S MN TYU UCÑJ WUKWN KNI JHND UCÑJ ALUI WUKWN.
MUCHO, Y LO QUE ESTA HECHO CON AMOR ESTA BIEN HECHO.

	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	1	6	8			2	7	3	16	9	4	3	11	2		1	1	1	3	3	16	4	10		9	
Replacement	B	Z	S	R	W	J	P	M	N	A	C	I	L	O	T	X	V	F	G	Y	Q	E	D	H	Ñ	U	K

2) [400 points] Solve this Morbit cipher, which is a quote from Leslie Knope from Parks and Rec. Part of the key is 4=×●, 7= ×-, 8=-●, 3=-×

9 6 5 4 4 8 7 5 3 3 6 6 4 9 8 7 8 2 6 6 4 5 4 8 7 4 6
 ●×●●●-×●×●-●×-●--×-×●●●●×●●×-●×--●××●●●●×●●-×●-●×-×●●●
E V E R Y T H I N G / H U R T S

2 5 7 9 8 9 4 9 7 3 7 6 7 5 3 6 7 9 1 9
 ××●-×-●×-●●××●●××--××-●●×-●--×●●×-●×--●×
/ A N D / I / M / D Y I N G

5) **[200 points]** Using the key HOUSTONTX encode LETS GO ASTROS

$$\begin{pmatrix} H & O & U \\ S & T & O \\ N & T & X \end{pmatrix} \equiv \begin{pmatrix} 7 & 14 & 20 \\ 18 & 19 & 14 \\ 13 & 19 & 23 \end{pmatrix}$$

L	E	T	S	G	O	A	S	T	R	O	S
T	U	G	W	K	U	I	K	Z	Z	S	R

6) **[100 points]** Decrypt this Caesar, which is a quote from Parks and Rec encrypted with a shift of 17

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

7) [400 points] Decrypt this Baconian, which is a quote from the Office.

????!?!??????!????!?!????!?!??????!?!?!????!???
 AAAABAABAAAAAABAAAABAAABAAAABAABAAAAAABAABABAAABAAA
 B E A R S B E A T S B

?!?????!?!?!?!?!?!?!?!?!?!?!?!?!?!?!?!?!?!?!?!?!?!?!?!?!?
 ABAAAAABAABABABAABAABABAABAABAABBAABAABAAAAAABAABAAABAA
 A T T L E S T A R G

?????!?!??????????!?!?!?!?!?!?????!!??????
 AAAABABAAAAAABABAABAABAABAAAAAABAABAAAA
 A L A C T I C A

Bears. Beats. Battlestar Galactica

8) [300 points] Solve this Aristocrat, which is a quote from Dwight from the Office.

FQGEWFWZ WIGBW FM ELW T RLSG RFC! CFOOFLEM LB
 IDENTITY THEFT IS NOT A JOKE JIM! MILLIONS OF

BTCFOFGM MXBBGH GDGHZ ZGTH!
 FAMILIES SUFFER EVERY YEAR!

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

9) [150 points] Solve this Caesar Shift, which is a quote from the Office.

B	M	T	E	D	T	E	H	M	,	L	H	B	'	O	X	E	X	T	K	G	X	W	M	H	M	N	G	X
I	T	A	L	K	A	L	O	T	,	S	O	I	'	V	E	L	E	A	R	N	E	D	T	O	T	U	N	E

F	R	L	X	E	Y	H	N	M	.
M	Y	S	E	L	F	O	U	T	.

10) [150 points] Encrypt the following Brooklyn 99 quote with an affine cipher with a key of $a=7$, $b=9$.

I	T	'	S	G	I	N	A	'	S	P	H	O	N	E	,	L	E	A	V	E	M	E	A	V	O	I	C	E	M	A	I	L	.
N	M	'	F	Z	N	W	J	'	F	K	G	D	W	L	,	I	L	J	A	L	P	L	J	A	D	N	X	L	P	J	N	I	.

I	W	O	N	'	T	C	H	E	C	K	I	T	'	C	A	U	S	E	I	T	'	S	N	O	T	1	9	9	3	.
N	H	D	W	'	M	X	G	L	X	B	N	M	'	X	J	T	F	L	N	M	'	F	W	D	M	1	9	9	3	.

11) [250 points] Encrypt the following Brooklyn 99 quote using a Vigenere cipher with the key BROOKLYN

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

K	L	Y	N	B	R	O	O	K	L	Y	N	B	.	-	R	O	O	K	L	Y	N	B	R	O	O
O	U	T	O	F	M	Y	C	E	R	E	A	L	.	-	J	A	K	E	P	E	R	A	L	T	A
Y	F	R	B	G	D	M	Q	O	C	C	N	M	.	-	A	O	Y	O	A	C	E	B	C	H	O

12) [400 points] Solve Aristocrat, which is a Parks and Rec quote that may contain spelling errors.

TM'L YTEN T HYZHQL LHQ. ZPNU YQWN KTXNL QII YNOIUL,
 IT'S LIKE I ALWAYS SAY. WHEN LYFE GIVES YOO LEMONS,

QID LNY Y LION IW QIDS KSHUBOH'L VIIYNSQ HUB KI
 YOU SELL SOME OF YOUR GRANDMA'S JOOLERY AND GO

AYDCCTUK.
 CLUBBING.

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

15) [450 points] Decrypt this Aristocrat, which is a quote from the Office that may contain spelling errors.

ULNREJNRU EOR DTLEORU VE HVW CJSU VGR EYL PTVUOF URY
 SOMETIMES THE CLOTHES AT GAP KIDS ARE TWO FLASHY SEW

J'N PLGDRS EL HL ELL EOR VNRGJDVK HJGT UELGR VKS
 I'M FORCED TO GO TOO THE AMERICAN GIRL STORE AND

LGSRG DTLEORU PLAG TVGHR DLTLKJVT SLTTU.
 ORDER CLOTHES FOUR LARGE COLONIAL DOLLS.

	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	5	10	1	9	4		6	3	15		4	5	3		13	5	9	9	9	1		2	
Replacement	U	V	K	C	T	Y	R	G	B	I	N	O	J	M	H	F	X	E	D	L	S	A	P	Z	W	Q

16) [200 points] Decrypt the following quote from Parks and Rec using an Affine cipher with the key a=19, b=17.

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

K H W B P O ?	C P W	D R C Q P O .	L F	P E O N C P	R Q R C O L P E O
B U D G E T ?	R E D	C A R P E T .	M Y	E N T I R E	A P A R T M E N T

N V	C P W	D R C Q P O .
I S	R E D	C A R P E T .

17) [600 points] Solve this Patristocrat, which is a quote from Parks and Rec that begins with the word WARNING.

JFIMC MKZCK ZBLXL BOSDO JFKKL IVSHC MKUZI SGKZ
 WARNI NGHIG HLEVE LSOFS WAGGE RCOMI NGTHR OUGH

Warning: high levels of swagger coming through

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

18) [300 points] Solve this Aristocrat, which is a quote from the Office encrypted with a K1 key.

AEIU P AJSRIM PU XEPH TFGUPUO P HJA XEJX XEI NSJO
 WHEN I WALKED IN THIS MORNING I SAW THAT THE FLAG

AJH JX EJSN-TJHX, P XEFYOEX, `JSS GPOEX, JUFXEIG
 WAS AT HALF-MAST, I THOUGHT, `ALL RIGHT, ANOTHER

KYGIJYLGJX JXI PX!' JUM XEIU P HJA PX AJH SPS'
 BUREAUCRAT ATE IT!' AND THEN I SAW IT WAS LIL'

HIKJHXPJU. EJSN-TJHX PH XFF EPOE. HEFA HFTI MJTU
 SEBASTIAN. HALF-MAST IS TOO HIGH. SHOW SOME DAMN

GIHVILX.
 RESPECT.

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	7				14	7	6	13	11	21	2	2	3	3	5	14		1	8	5	9	1		19	3	
Replacement	W	X	Y	Z	H	O	R	S	E	A	B	C	D	F	G	I	J	K	L	M	N	P	Q	T	U	V

19) [300 points] Solve this Aristocrat, which is a Brooklyn 99 quote encrypted with a K2 key

TUEUSEZGUD, YFC KYLEXOJ SCZKU DEPEZDEZSD PCU TFU. Z
 DETECTIVES, OUR MONTHLY CRIME STATISTICS ARE DUE. I

HPLE NPNUCHYCR YL POO JYFC SOYDUT SPDUD QJ EYKYCCYH.
 WANT PAPERWORK ON ALL YOUR CLOSED CASES BY TOMORROW.

DSFOOJ, JYF SPL BFDE HCZEU "Z TZTL'E SOYDU PLJ" YL P
 SCULLY, YOU CAN JUST WRITE "I DIDN'T CLOSE ANY" ON A

NZUSU YV NPNUC.
 PIECE OF PAPER.

Replacement	P	Q	S	T	U	V	W	X	Z	B	R	O	K	L	Y	N	A	C	D	E	F	G	H	I	J	M
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		1	10	10	11	6	1	4		6	3	7		5	7	10	1	1	9	5	14	1		1	13	9

20) [450 points] Solve this quote from the Office encrypted with a Pollux cipher. Part of the key is 3=•, 9=•, 8=-, 5=X

884513150978790652871390296218087129139203167291679888
 ●●xx-●-x-●x●x●--xx●x-●●-x●-x-●-●x-x●-●●x-●--xx●-x●●●●●
 I K N E W E X A C T L Y W H

530407267011771834600256889498140429351357314460599170919
 x●-x-xx-x---xx-●●x---xx-●●●x●●-x-xx●●x-●xx●-xx---x●●-x-●-●
 A T T O D O B U T I N A M U C

283882511710158032325913732967363325938785182899582798
 x●●●●xx---x---x●-●x●xx●-●x●x●-x●-●●xx●●●x●x-●x●●●x●xx●●
 H M O R E R E A L S E N S E I

74838829671984208410157392689595867236158389736215504101
 xx●●●●x●-x-●●xx-●x---xx●●x-●●x●x●-xx●--x●●●●x●-x-xx-x---
 H A D N O I D E A W H A T T O

476837661
 xx-●●x---
 D O

21) [600 points] Solve this Patristocrat, which is a Parks and Rec quote about breakfast food where the word EGGS appears twice.

DKYAI DFIZG NFKYW FNDKY FGILR AGOID BPIJN GRIUK
 YOUMA YHAVE THOUG HTYOU HEARD MESAY IWANT EDALO

NKSXI VKJIJ RGWWO XYNPF INBOI BRPIO WBZGA GIUUN
 TOFBA CONAN DEGGS BUTWH ATISA IDWAS GIVEM EALLT

FGXIV KJIJR GWWOD KYFIZ G
 HEBAC ONAND EGGSY OUHAV E

You may have thought you heard me say I wanted a lot of bacon and eggs, but what I said was: Give me all the bacon and eggs you have.

	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	4		5		7	10		15	5	8	1		7	5	3		5	1		3	2	6	3	5	3
Replacement	M	I	Z	Y	X	H	E	K	A	N	O	R	P	T	S	W	J	D	F	Q	L	C	G	B	U	V

22) [550 points] Special Agent, Gabriel, has the following RSA public key:

$$n = 944423 \quad e = 871187$$

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

$$944423 = 953 * 991$$

Compute the value of their private key:

Enter the computed private key:

417323