

Science Olympiad — Scioly person1's

Codebusters Test

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.
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

SAMPLE 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: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:30	120
X:36	96
X:42	72
X:48	48
X:54	24

X:25	140
X:31	116
X:37	92
X:43	68
X:49	44
X:55	20

X:26	136
X:32	112
X:38	88
X:44	64
X:50	40
X:56	16

X:27	132
X:33	108
X:39	84
X:45	60
X:51	36
X:57	12

X:28	128
X:34	104
X:40	80
X:46	56
X:52	32
X:58	8

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.

7. 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	18
2	17
3	16
4	7
5	6
6	15
7	19
8	9
9	14
10	12
11	3
12	13
13	2
14	1
15	8
16	20
17	10
18	4
19	Timed
20	5
21	11

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 [200 points] Decode this quote by Nelson Mandela. When you have solved it, raise your hand so that the time can be recorded and the solution checked.

ZYPO R SRO DM HPODPH WYP TDJYW WB ADEP WYP ADKP YP
 WHEN A MAN IS DENIED THE RIGHT TO LIVE THE LIFE HE

QPADPEPM DO, YP YRM OB FYBDFP QVW WB QPFBSR RO
 BELIEVES IN, HE HAS NO CHOICE BUT TO BECOME AN

BVWARZ.
 OUTLAW.

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

1) [300 points] Decode this quote by Anne Frank which has been encoded with the Pollux Cipher. 4,6 = O, 5,7,3 = X, and 0 = -

822544665211545686254561455885686554884541542265822852621

●--x●●●●x---x●x●●●-x●x●-●xx●●x●●●xx●●●●x●-x●--●x●--●x●-●--

W H O E V E R I S H A P P Y

55411546581485428855215615141565522152546845858165664

xx●--x●●x●-●●x●-●●xx--x●-x-●-x●xx---x-x●●●●x●x●-●x●●●

W I L L M A K E O T H E R S

55684656254116581265182255252115122

xx●●●●x●-x●--●x●--●x-●--xx-x---x---

H A P P Y T O O

2) [300 points] Decode this quote by Bob Marley, which has been encoded with the Baconian Cipher.

51627890512679085167285967801256978506178256785960781

ABABAABBABBAABBAABAABAABAABBBAABAABABAABAAAAABABAAB

L O V E T H E L I F E

56279085126907812596078156728590671856279850678156297

AABABBAABBABBAABBABABAABAABAABBAABAABABAABAAABAABBA

Y O U L I V E L I V E

80561782567901852678950671856782596708516297801529670

ABAABAABAABBBAABAABAABAABAABAABAABAABAABAABAABAABAABA

E T H E L I F E Y O U

182596701829560178256

BABABAABBABBAABBAABAA

L O V E

Love the life you live. Live the life you love.

3) [325 points] Decode this quote by Charles Dickens which has been encoded with the Baconian Cipher.

zqxwcnzxcnzuxicnqzxcwnzxecnzuxicqwnzxcnzxceunzixcnqw
 ABABAABAAAAABABAABAAABAAABAAABABABBAAAAAAABBAABAAABB
 L I F E I S M A D E O

zexcunizxqcnwzxeucnizxqcnzxcwcnzexuicqnwzeuxcnzxcicqz
 ABAABABAABAABAABBAABAABAABAABAABABBBABABABBAAAAAABBAAB
 F E V E R S O M A N

xeucniqwxcnzxecnzxucnizxqcnzxcwcnzxcuicqnxwecunzxcin
 ABBAABBBAAAAAABAAAABAABAABAABAABAABAABBAABAABBAABAABA
 Y P A R T I N G S W E

zxqcnwzxcunzixcnzxcqwecnuzxiqcnzxeucnizxqcnwzxcuinz
 AABABAABBAABAABAABBAABAABAABAABAABAABAABAABAABAABBA
 L D E D T O G E T H

qxcwnzxc
 BAABAAAA
 E R

Life is made of ever so many partings welded together.

4) [200 points] Decode this phrase which has been encoded with the caesar cipher.

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

5) [150 points] Encode this phrase using the Caesar cipher with an offset of 16.

E	N	V	I	R	O	N	M	E	N	T	A	L	C	H	E	M	I	S	T	R	Y
U	D	L	Y	H	E	D	C	U	D	J	Q	B	S	X	U	C	Y	I	J	H	O

6) [600 points] Decode this quote which has been encoded as a Xenocrypt.

OY DBZJPZ XH ZARNPZ, OY CZXPZ NHOH DBZJZ MBYXUH OY
 LA MUERTE NO EXISTE, LA GENTE SOLO MUERE CUANDO LA

HOLRUYX; NR TBZUZN JZMHJUYJDZ NRZDTJZ ZNPYJZ MHXPRCH
 OLVIDAN; SI PUEDES RECORDARME SIEMPRE ESTARE CONTIGO

	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	4	2	4				8		7		1	3	6		5	5		5		2	4			5	7	16
Replacement	X	U	G	M	J	W	B	O	H	R	Q	V	C	S	F	L	T	K	I	Y	P	D	Z	Ñ	N	A	E

7) [600 points] Decode this quote by Rodrigo Díaz de Vivar which has been encoded as a Xenocrypt.

LFLEG AÑLMWÑ EZHTGRSZL TZW BZR OFÑ LZ RFTSÑWZL HZWSW
 NUNCA TENDRE COMPASION POR LOS QUE NO SUPIERON MORIR

G ASÑHTZ.

A TIEMPO.

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

8) [250 points] Encode the phrase "Acceleration" with the Hill Cipher, with the keyword "hill".

$$\begin{pmatrix} H & I \\ L & L \end{pmatrix} \equiv \begin{pmatrix} 7 & 8 \\ 11 & 11 \end{pmatrix}$$

A	C	C	E	L	E	R	A	T	I	O	N
Q	W	U	O	F	J	P	F	P	L	U	L

9) [375 points] Decode this phrase given the encryption key "princeton".

$$\begin{pmatrix} P & R & I \\ N & C & E \\ T & O & N \end{pmatrix} \equiv \begin{pmatrix} 15 & 17 & 8 \\ 13 & 2 & 4 \\ 19 & 14 & 13 \end{pmatrix} \quad \text{Decode} \begin{pmatrix} P & R & I \\ N & C & E \\ T & O & N \end{pmatrix}^{-1} \equiv \begin{pmatrix} 20 & 25 & 0 \\ 23 & 19 & 14 \\ 8 & 7 & 19 \end{pmatrix}$$

S	U	N	V	T	F	H	G	M	B	U	R	K	K	O	S	E	G	Z	U	T
C	O	L	L	E	G	E	B	O	A	R	D	I	S	A	S	C	A	M	Z	Z

10) [200 points] Decode this quote by Benjamin Franklin which has been encoded with the Vigenère cipher with keyword "scioly".

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

11) [125 points] Encode the phrase "boomilever towers and bridges" with the Vigenere Cipher with the key "balsa".

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

12) [350 points] Decode this quote by Dr. Suess which has been encoded as an aristocrat with errors.

AZF CJLY KFFWJDEQ DE AZFW CJYV. AFZ CJLYY TZZS DE
 YOU HAVE BUURAINS IN YOUR HAED. YUO HAVEE FOOT IN

AZFW QCZYQ. AZF MJE QSYYW FWQYOT JED VDWYPSDZZE AZF
 YOUR SHOES. YOU KAN STEER URSELF ANI DIRECTION YOU

PCZZQY.
 CHOOSE.

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

13) [300 points] Decode this quote by Thomas Edison which has been encoded as an aristocrat.

ANT DTBQFBMF SBQVGBMM UWBM WG DWCWGD NY. FKB JAMF
OUR GREATEST WEAKNESS LIES IN GIVING UP. THE MOST

RBTFQWG SQI FA MNRRBBE WM QUSQIM FA FTI ZNMF AGB
CERTAIN WAY TO SUCCEED IS ALWAYS TO TRY JUST ONE

JATB FWJB.
MORE TIME.

	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	6	12	1	3	1	10	5		3	3	1		9	4			6	3	3	5	2	1	7		1	1
Replacement	O	E	V	G	D	T	N	B	Y	M	H	X	S	U	F	Z	A	C	W	R	L	K	I	Q	P	J

14) [350 points] Decode this quote by Winston Churchill, which has been encoded as an aristocrat.

LH CPB GJJR BPLQ HCPH QJSYAKPAI LB HCJ TYKBH DYKS YD
IT HAS BEEN SAID THAT DEMOCRACY IS THE WORST FORM OF

NYOJKRSJRH JMAJEH PZZ HCYBJ YHCJK DYKSB HCPH CPOJ
GOVERNMENT EXCEPT ALL THOSE OTHER FORMS THAT HAVE

GJJR HKLJQ DKYS HLSJ HY HLSJ.
BEEN TRIED FROM TIME TO TIME.

	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	6	7	4	1		2	15	1	16	8	6	1	1	2	7	3	4	7	1					10	2
Replacement	C	S	H	F	P	K	B	T	Y	E	R	I	X	G	V	A	D	N	M	W	Q	Z	U	J	O	L

15) [550 points] Decode this sentence, which has been encoded as an aristocrat.

SKVVG T SRNPJ SROOCVG YQ SRRJVOVKKHVJ, SVPPHWS SRRG
GREEDY GOATS GOBBLED UP GOOSEBERRIES, GETTING GOOD

NP SKNOOHS PAV SRRGHVJ
AT GRABBING THE GOODIES

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

16) [600 points] Decode this quote by James Cameron, which has been encoded as a patristocrat.

MUKBE ZYCKB EPOBH JZPMW MNEJB EZJKX MOXHS WMCZH
IFYOU SETYO URGOA LSRID ICULO USLYH IGHAN DITSA

UHMJE PYKBE RMJJU HMJHI BDYYD YPKBS YYJZY ZZENN YZZ
FAILU REYOU WILLE AILAB OVEEV ERYON EELSE SSUCC ESS

If you set your goals ridiculously high and it's a failure, you will fail above everyone else's success.

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

17) [600 points] Decode this quote by David Brinkley, which has been encoded as a patristocrat.

MKZTT WKKUZ OSMPD KGPWR IGTMP OMHMU DVSUG ZPXMA
 ASUCC ESSFU LMANI SONEW HOCAN LAYAF IRMFO UNDAT

DGPRD AIAIW JVDTL KGAIW VKIMQ WAIVG RPMAI DS
 IONWI THTHE BRICK SOTHE RSHAV ETHRO WNATH IM

A successful man is one who can lay a firm foundation with the bricks others have thrown at him.

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

18) [600 points] Builderguy135 and his friend Umaroth have the following RSA public key:

$$n = 387103 \quad e = 294267$$

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

$$387103 = 521 * 743$$

Compute the value of their private key:

Enter the computed private key:

161043

19) **[500 points]** Andrew and his friend Sophia have faithfully followed the steps of the RSA key-generation algorithm. Here are the results:

$$p = 419$$

$$q = 389$$

$$n = 162991$$

$$\phi = 162184$$

$$e = 3019$$

Unfortunately, they don't know how to compute the value of d and need you to do that final step for them.

Enter the computed value of d , NOT the formula.

95731

20) **[200 points]** Encode this name of a parasite where $a = 18$ and $b = 5$.

D	I	P	H	Y	L	L	O	B	O	T	H	R	I	U	M	L	A	T	U	M
H	T	P	B	V	V	V	X	X	X	J	B	Z	T	B	N	V	F	J	B	N