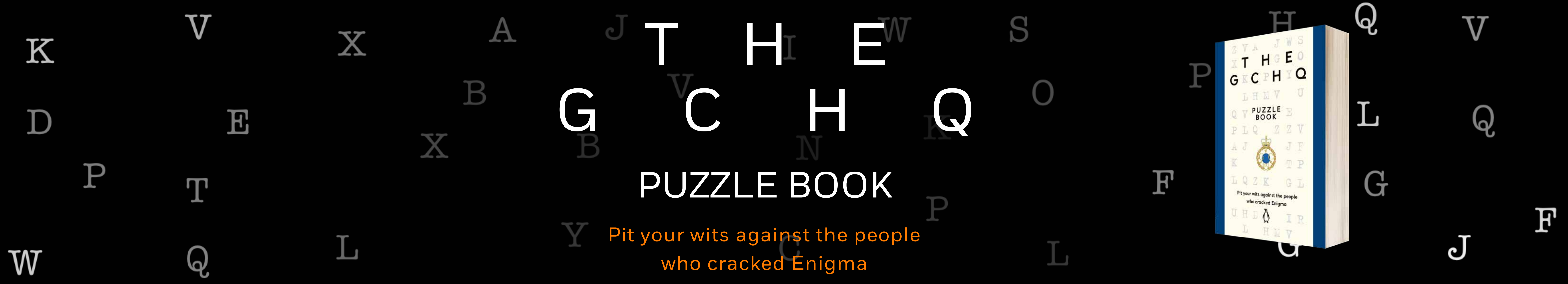


Kristmas Kwiz Challenge

Here are the answers to the Kristmas Kwiz Challenge, which is on pages 121-136 of The GCHQ Puzzle Book. Feel free to award yourself partial marks for partially complete answers. In a few cases I have added an explanation of how we would award partial marks.

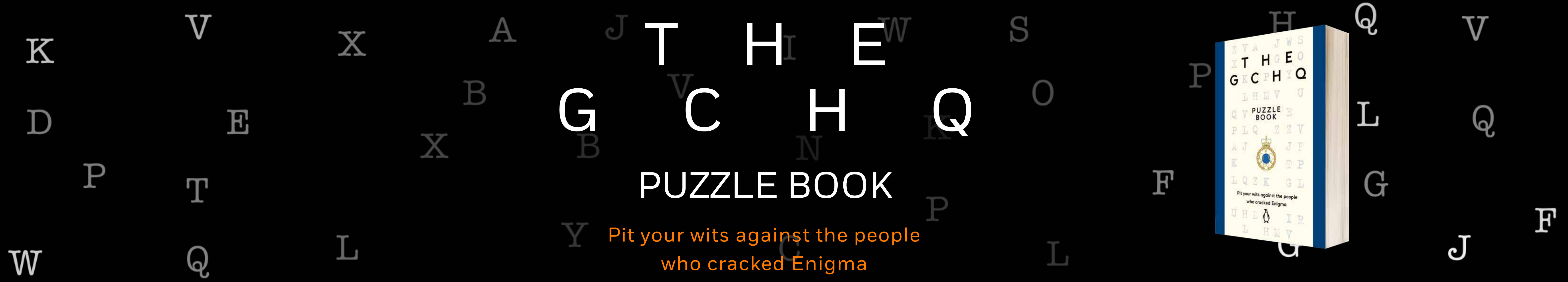
01. Eight. The numbers tally when n is replaced by $n!$ (sometimes pronounced 'n bang'): $8! = 28*24*60$. *[If this kwestion were to be attempted in a leap year, the answer would be the less snappy 'eight point zero one six three eight five five three four four eight eight six five (with fifteen digits of precision)' as $8.01638553448865! = \Gamma(9.01638553448865) = 41760.0000000000$].*

6! (720) hours hath September,
April, June and November,
All the rest have 4! (24) more,
Excepting February alone,
And that has 8! (40320) minutes?



02. Between GREEN and POLITICS.

CAMP	KING	CURRENT	CHAIR		STINKING
<i>AIDE</i>	<i>ALBERT</i>	<i>AMPERE</i>	<i>BATH</i>		<i>BISHOP</i>
FASHION	HOLLY	LUMINOSITY	KNOWLEDGE		BACK
<i>BRISTOL</i>	<i>BUDDY</i>	<i>CANDELA</i>	<i>CHARACTER</i>		<i>CHAT</i>
PLEASURE	BALLET	GRACE	SCARE		SAGE
<i>CONSCIENCE</i>	<i>CORPS</i>	<i>COUP</i>	<i>CROW</i>		<i>DERBY</i>
DRAIN	EDDY	CAKE	VIE		Y
<i>DINAR</i>	<i>DUANE</i>	<i>DUNDEE</i>	<i>EAU</i>		<i>FENNI</i>
LANCE	DOUBLE	LUNGED	COMBAT		SCIENCE
<i>FER</i>	<i>GLOUCESTER</i>	<i>GULDEN</i>	<i>HORS</i>		<i>HUMANITY</i>
BREAM	TEMPERATURE	MASS	MUD		RED
<i>JULIAN</i>	<i>KELVIN</i>	<i>KILOGRAM</i>	<i>LARK</i>		<i>LEICESTER</i>
RAIL	REED	INMATE	LENGTH		AMOUNT
<i>LIRA</i>	<i>LOU</i>	<i>MANETI</i>	<i>METRE</i>		<i>MOLE</i>
COMMERCE	YOUNG	POSE	GREEN	<u>ROCK</u>	POLITICS
<i>MORALITY</i>	<i>NEIL</i>	<i>PESO</i>	<i>PETER</i>	<u>PLYMOUTH</u>	<i>PRINCIPLE</i>
GUARD	CROSS	WORSHIP	STEAK		TIME
<i>RAIL</i>	<i>RUFF</i>	<i>SACRIFICE</i>	<i>SALISBURY</i>		<i>SECOND</i>
STEEL	WHITE	CURSE	LAC		PAT
<i>SHEFFIELD</i>	<i>STILTON</i>	<i>SUCRE</i>	<i>TEAL</i>		<i>TERN</i>
FORCE	BLUE	NOW	WEALTH		HAM
<i>TOUR</i>	<i>VINNEY</i>	<i>WON</i>	<i>WORK</i>		<i>YORK</i>



Themes

Can be followed by a 4-letter bird to make a word: **BACKCHAT**, **SCARECROW**, **MUDLARK**, **GUARDRAIL**, **CROSSRUFF**, **LACTEAL**, **PATTERN**

Base SI units: **CURRENT**/AMPERE, **LUMINOSITY**/CANDELA, **TEMPERATURE**/KELVIN, **MASS**/KILOGRAM, **LENGTH**/METRE, **AMOUNT**/MOLE, **TIME**/SECOND

Gandhi's Seven Blunders of the World: **KNOWLEDGE** WITHOUT CHARACTER, **PLEASURE** WITHOUT CONSCIENCE, **SCIENCE** WITHOUT HUMANITY, **COMMERCE** WITHOUT MORALITY, **POLITICS** WITHOUT PRINCIPLE, **WORSHIP** WITHOUT SACRIFICE, **WEALTH** WITHOUT WORK

Anagram of currency: **DRAIN**/DINAR, **LUNGED**/GULDEN, **RAIL**/LIRA, **INMATE**/MANETI, **POSE**/PESO, **CURSE**/SUCRE, **NOW**/WON

Guitarists: **ALBERT KING**, **BUDDY HOLLY**, **DUANE EDDY**, **JULIAN BREAM**, **LOU REED**, **NEIL YOUNG**, **PETER GREEN**

British cheese: **STINKING BISHOP**, **SAGE DERBY**, **Y FENNI**, **DOUBLE GLOUCESTER**, **RED LEICESTER**, **WHITE STILTON**, **BLUE VINNEY**

X DE Y: AIDE DE **CAMP**, CORPS DE **BALLET**, COUP DE **GRACE**, EAU DE **VIE**, FER DE **LANCE**, HORS DE **COMBAT**, TOUR DE **FORCE**

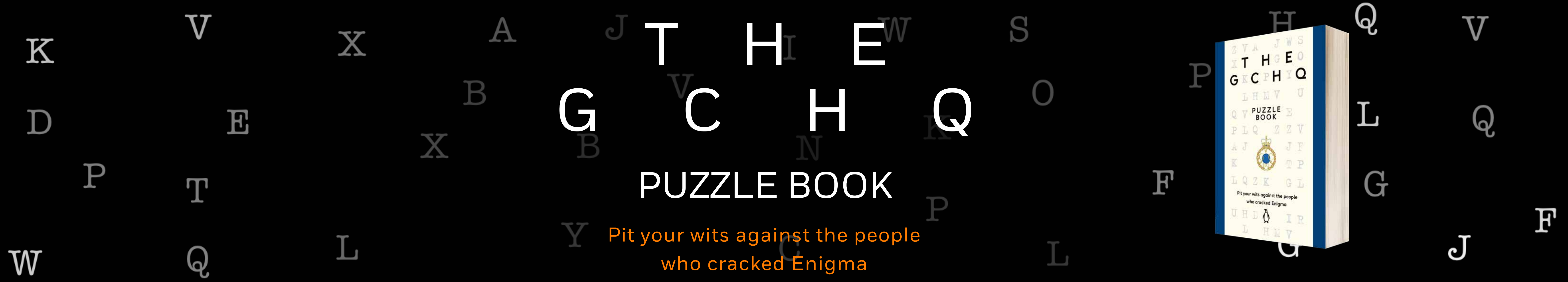
Can be preceded by UK city: **BATH CHAIR**, **BRISTOL FASHION**, **DUNDEE CAKE**, **PLYMOUTH ROCK**, **SALISBURY STEAK**, **SHEFFIELD STEEL**, **YORK HAM**

Scoring notes: Placing **ROCK** in the correct place scores full marks, even if you didn't spot all the themes. Otherwise award yourself half a mark for each theme spotted.

03. **ATTILA REES** [*the Police Constable, an anagram of RETALIATES*] (a), **CAPTAIN CAT** [*the blind sea captain*] (b), **WILLY NILLY** [*the postman*] (c), **JACK BLACK** [*the cobbler, whose namesake voices Kung Fu Panda*] (d), **MR PUGH** [*the schoolmaster, who presumably would sit on a pew*] (e) all live in **LLAREGGUB** [*the village in Dylan Thomas' Under Milk Wood, its derivation being 'Bugger All' backwards*] (f).

Scoring notes: award yourself half a mark for each part.





04. IMP.

10 (*synonyms ending -TEN*): ABRIDGE/SHORTEN, BAPTISE/CHRISTEN, CONSTRICT/TIGHTEN, DEFEATED/BEATEN, ENAMOURED/SMITTEN, FREQUENTLY/OFTEN, NIPPED/BITTEN, SCARE/FRIGHTEN, SHINE/GLISTEN, SMOOTH/FLATTEN (or STRAIGHTEN)

9 (*'a stitch in time saves nine'*): ARSENIC, AVENUE, EINSTEINIUM, HAWAII, INTRAMUSCULAR, NANOTESLA, SPAIN, TECHNETIUM, TITANIUM can be abbreviated to AS, AV, ES, HI, IM, NT, ES, TC, TI respectively; these abbreviations can be rearranged to AS/TI/TC/HI/NT/IM/ES/AV/ES

8 (*'after eight'/synonyms of AFTER*): BEHIND, FOLLOWING, LATER, NEXT, POST, PURSUING, SUBSEQUENT, SUCCEEDING

7 (*'Magnificent 7'/words that rhyme with the surnames of the actors who played them in the film*): BEAN/STEVE MCQUEEN, CUCKOLDS/HORST BUCHHOLZ, DAWN/ROBERT VAUGHN, JOHNSON/CHARLES BRONSON, TEXTER/BRAD DEXTER, WINNER/YUL BRYNNER, WOBURN/JAMES COBURN

6 (*'six pack'/can be preceded by PACK OF when in the plural*): CARD, COYOTE, DOG, LIE, THIEF, WOLF

5 (*'five gold rings'/words containing ORO*): BORON, HERBIVOROUS, METEOROLOGY, MOROCCO, THOROUGHbred

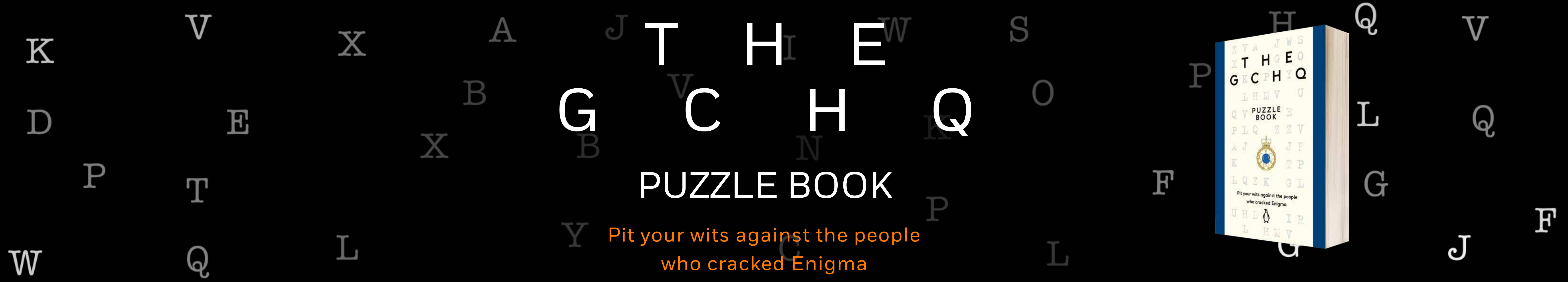
4 (*one of a set of FOUR*): AUTUMN (FOUR SEASONS), SPEECH (FOUR FREEDOMS), STUBBS (FOUR TOPS), WAR (FOUR HORSEMEN OF THE APOCALYPSE)

3 (*can be preceded by THIRD*): MAN, PARTY, WORLD

2 (*'a couple'/can be followed by COUPLE*): THERMO, ODD

1 (*can be followed by 'unity'*): IMP

Scoring notes: Identifying IMP scores full marks, even if you didn't spot all the themes. Otherwise award yourself half a mark for each theme spotted.



05. BAP. The other words are formed from letters which are adjacent on a standard English keyboard.

06. 35. The n^{th} ($n = 1, \dots$) term of the series is the number of positive integers that, when spelled out in (UK or US) English, contain n letters. (*The 35 numbers that contain 10 letters are: 24, 25, 29, 34, 35, 39, 43, 47, 48, 53, 57, 58, 63, 67, 68, 71, 72, 76, 84, 85, 89, 94, 95, 99, 100, 200, 600, 1000000, 2000000, 6000000, 10000000, 1000000000, 2000000000, 6000000000, 10000000000.*)

07.

- (a) CHEW
- (b) STOCK

The names DOCTOR WATSON and SHERLOCK HOLMES can be broken down to the components DOC, TOR, WAT, SON, SHER, LOCK, HOLM, ES.

In (a) (clue: 'a' for 'after'), all but one of these components can be placed after one of the words given and the remaining component can be placed before the remaining word: ANGKOR WAT, BISON, ESCHEW, GLASTONBURY TOR, KOSSHER, PAPA DOC, PADLOCK, STOCKHOLM

In (b) (clue: 'b' for 'before'), all but one of these components can be placed before one of the words given and the remaining component can be placed after the remaining word: SHERBET, ESTEEM, DOC HOLLIDAY, LOCKJAW, TORMENTOR, SONNET, STOCKHOLM, WAT TYLER

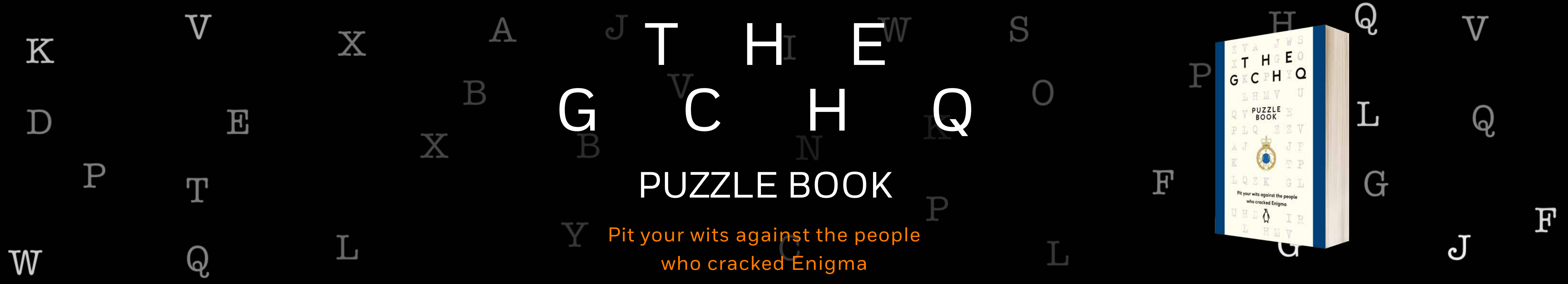
08.

(STOP STOP)
(STOP STOP)

The words in each matrix have 0, 1, 2, 3 letters in common with STOP. The letters of the word STOP also advance cyclically through the words.

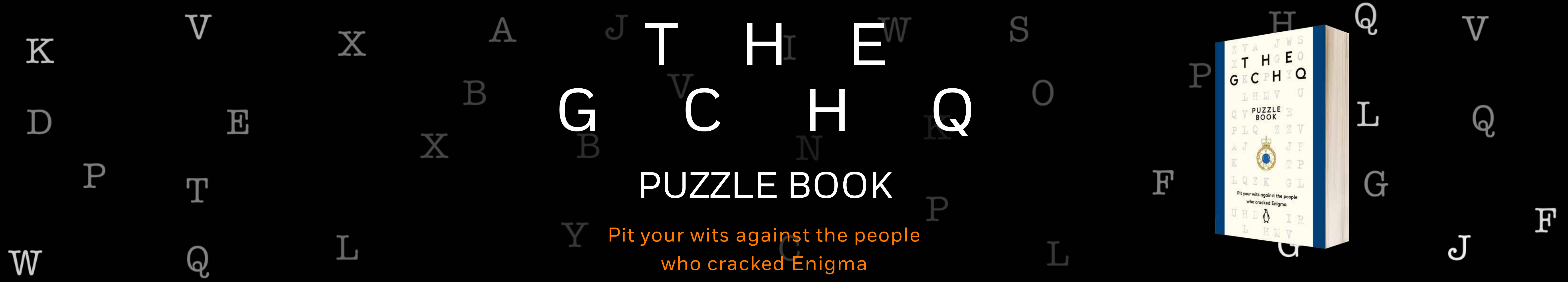
(MAKE QUIZ) (PLUG USER) (OPEN APSE) (TOPE FOPS) (STOP STOP)
(VERY HARD) (BI TE EXCO) (JU ST OMIT) (TAPS TOWS) (STOP STOP)

09. SILVER – all elements can be spelled (in at least one way) using symbols of elements.



10. FIVE. When the letters of the numbers spelled out (MINUS THREE, ZERO, ROOT TWO, ONE, TWO, THREE, PI, SIX, NINE, TEN, FIFTEEN, SIXTEEN, FORTY, EIGHTY ONE, NINE THOUSAND, ELEVEN MILLION) in the standard word search style are omitted, the remaining letters spell out 'BUT WHICH NUMBER DOES THE SEARCH REVEAL' and their positions reveal the answer.

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



11.

(a) ARGENTINA (BUENOS AIRES), MALAYSIA (KUALA LUMPUR), CAMBODIA (PHNOM PENH), PAPUA NEW GUINEA (PORT MORESBY), BENIN (PORTO-NOVO), DOMINICAN REPUBLIC (SANTO DOMINGO), MONGOLIA (ULAN BATOR) – countries originally sorted by the second word in the capital's name, now by the first.

(b) EDGAR (ALLAN POE), HARRIET (BEECHER STOWE), HANS (CHRISTIAN ANDERSEN), ARTHUR (CONAN DOYLE), GABRIEL (GARCÍA MÁRQUEZ), ROBERT (LOUIS STEVENSON), LOUISA (MAY ALCOTT), ALEXANDER (MCCALL SMITH), ERLE (STANLEY GARDNER), BARBARA (TAYLOR BRADFORD) – authors commonly known by a three-word name originally ordered by the last word, now by the second.

(c) RAG (AND BONE MAN), HELL (AND HIGH WATER), FOOL (AND HIS MONEY), LIVE (AND LET DIE), LEEK (AND MANIFOLD RAILWAY), JESUS (AND MARY CHAIN), FOOT (AND MOUTH DISEASE), JACK AND THE BEANSTALK, TIME (AND TIME AGAIN)

or

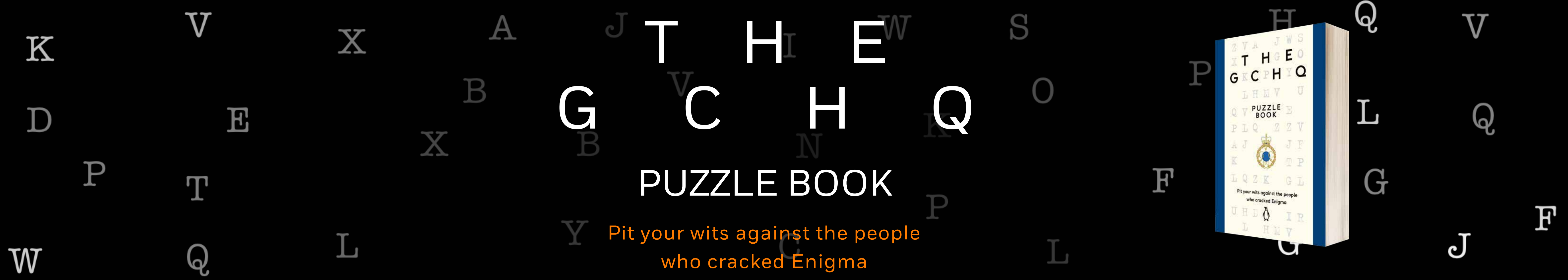
RAG (AND BONE MAN), HELL (AND HIGH WATER), FOOL (AND HIS MONEY), LIVE (AND LET DIE), JESUS (AND MARY CHAIN), FOOT (AND MOUTH DISEASE), LEEK (AND POTATO SOUP), JACK (AND THE BEANSTALK), TIME (AND TIME AGAIN) – phrases 'X AND Y Z' originally ordered by Z, now by Y.

(d) TIM (BERNERS LEE), (LEE) VAN (CLEEF), JUSTIN (LEE COLLINS), JAMIE (LEE CURTIS), JOHN (LEE HOOKER), TOMMY (LEE JONES), JERRY (LEE LEWIS), JONNY (LEE MILLER), (LEE) HARVEY (OSWALD), LYNDA (LEE-POTTER), DAVID (LEE ROTH), (LEE) KUAN (YEW) – people originally ordered by first non-LEE name, now by second non-LEE name.

12.

(a) X FACTOR: I, II, V (1, 2, 5) are the factors of X (10)

(b) KRYPTON FACTOR: H, He, Li, Be, C, F, Mg, Ar have atomic numbers 1, 2, 3, 4, 6, 9, 12, 18; these are the factors of 36, the atomic number of Kr(ypton).



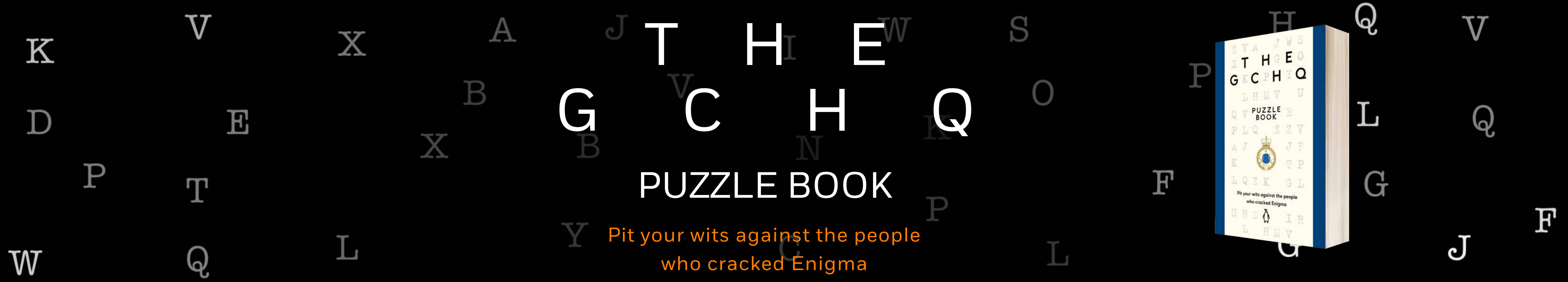
13. The final words are all well-known creatures. (*Other routes may exist, some to less well-known creatures; answers resulting from such routes will be deemed correct.*)

LAND → BAND → BEND → BEAD → **BEAR**
 SLOT → BLOT → BOOT → BOAT → **BOAR**
 SHIP → CHIP → CLIP → CLAP → **CLAM**
 SHOW → CHOW → CROW → CRAW → **CRAB**
 WILD → GILD → GOLD → GOAD → **GOAT**
 KILT → HILT → HALT → HART → **HARE**
 → *MILT* → *MALT* → *MART* → **MARA**
 → *MILT* → *MALT* → *MART* → **MARE**
 → *MILT* → *MALT* → *MAST* → **MASU**
 ITEM → STEM → SEEM → SEAM → **SEAL**
 WHAM → SHAM → SLAM → SLUM → **SLUG**
 → *SHAM* → *SCAM* → *SCUM* → **SCUP**
 → *SHAM* → *SLAM* → *SLIM* → **SLIP**
 CHOP → SHOP → SWOP → SWAP → **SWAN**
 HAVE → WAVE → WOVE → WORE → **WORM**

14. SPANISH INQUISITION. The 4-letter word generating the key stream is SPAM and the plain text is:

DEAD PARR OTSK ETCH	<i>DEAD PARROT SKETCH</i>
CHEE SESH OPSK ETCH	<i>CHEESE SHOP SKETCH</i>
THEM EANI NGOF LIFE	<i>THE MEANING OF LIFE</i>
NOBO DYEX PECT STHE	<i>NOBODY EXPECTS THE <u>SPANISH INQUISITION</u></i>

If you have a theory that the key stream SPAMSPAMSPAMSPAM is based on "SPAM! SPAM! SPAM! SPAM!" occurring in the chorus of Monty Python's Spam Song, then this theory that you have - that is to say, which is yours - is yours.



15. In the question and in each of the sequences, only the first occurrence of a letter or digit is present; subsequent occurrences are omitted regardless of case. The question originally read: "Which two terms begin each of the following sequences? "

(a) **RED, YLOW** (snooker balls in order of score: RED, YELLOW, GREEN, BROWN, BLUE, PINK, BLACK)

(b) **FIRST, ECOND** (ordinals: FIRST, SECOND, THIRD, FOURTH, FIFTH, SIXTH, SEVENTH, EIGHTH, NINTH, TENTH, ELEVENTH, TWELFTH, ...)

(c) **1, -** (powers of 11: 1, 11, 121, 1331, 14641, 161051, 1771561, 19487171; the setters note that, on the assumption that the sequence is purely numeric, no knowledge of how the sequence generation is needed for solution)

(d) **QUEBC, WHISKY** (typewriter keyboard letters in NATO phonetics: QUEBEC, WHISKEY, ECHO, ROMEO, TANGO, YANKEE, UNIFORM, INDIA, OSCAR, PAPA, ALPHA, SIERRA, DELTA, FOXTROT, GOLF, HOTEL, JULIET, KILO, LIMA, ZULU, XRAY, CHARLIE, VICTOR, BRAVO, NOVEMBER, MIKE)

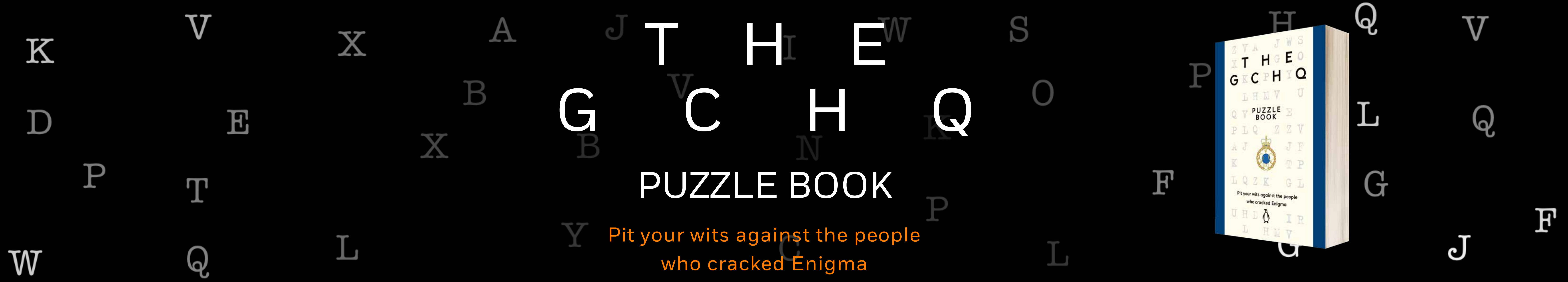
(e) **BULASR, IVY** (English names of Pokémon™ characters in National Pokédex™ order: BULBASUR, IVYSAUR, VENUSAUR, CHARMANDER, CHARMELEON, CHARIZARD, SQUIRTLE, WARTORTLE, BLASTOISE, CATERPIE, METAPOD, BUTTERFREE, WEEDLE, KAKUNA, BEEDRILL, PIDGEY, PIDGEOTTO, PIDGEOT, RATTATA, RATICATE, SPEAROW, FEAROW, EKANS, ARBOK, PIKACHU, RAICHU, SANDSHREW, SANDSLASH, NIDORAN, NIDORINA, NIDOQUEEN, NIDORAN, NIDORINO, NIDOKING, CLEFAIRY, CLEFABLE, VULPIX, NINETALES, JIGGLYPUFF, ...)

(f) **PAR, BIDE** (equal/under par scores in golf: PAR, BIRDIE, EAGLE, ALBATROSS, CONDOR, OSTRICH, PHOENIX)

(g) **TALC, GYPSUM** (Mohs scale of mineral hardness: TALC, GYPSUM, CALCITE, FLUORITE, APATITE, ORTHOCLASE, QUARTZ, TOPAZ, CORUNDUM, DIAMOND)

16. Iron. The block of the periodic table containing the elements 21-86 with the named elements highlighted is:

Scandium	Titanium	Vanadium	Manganese	Iron	Cobalt	Copper	Zinc	Gallium	Arsenic	Selenium	Bromine
	Zirconium		Technetium			Silver		Indium	Antimony		Iodine
Lutetium	Hafnium	Tantalum	Rhenium			Gold	Mercury	Thallium	Bismuth		Astatine



17. YAEYAMA ISLANDS. The question is "Where, precisely, did one of the setters holiday this year?" enciphered with keyword "Japan". The list is HATERUMA, HATOMA, IRIOMOTE, ISHIGAKI, KOHAMA, TAKETOMI enciphered with keyword YAEYAMA ISLANDS (of which they are part). The cipher alphabets in full are:

Plaintext: ABCDEFGHIJKLMNOPQRSTUVWXYZ
 Question: JAPNBCDEFGHIKLMOQRSTUVWXYZ
 Words: YAEMISLNDBCFGHJKOPQRTUVWXZ

18. THE HOBBIT (or THERE AND BACK AGAIN). With A=0, ..., Z=25 the encipherment is formed by adding the list of chapters

AN UNEXPECTED PARTY, ROAST MUTTON, A SHORT REST, OVER HILL AND UNDER HILL, RIDDLES IN THE DARK, OUT OF THE FRYING-PAN INTO THE FIRE, QUEER LODGINGS, FLIES AND SPIDERS, BARRELS OUT OF BOND, A WARM WELCOME, ON THE DOORSTEP, INSIDE INFORMATION, NOT AT HOME, FIRE AND WATER, THE GATHERING OF THE CLOUDS, A THIEF IN THE NIGHT, THE CLOUDS BURST, THE RETURN JOURNEY, THE LAST STAGE

and this text reversed.

19.

(a) ANCHOVIES. The ingredients listed in the question are: COS LETTUCE, CROUTONS, LEMON JUICE, OLIVE OIL, EGG, WORCESTERSHIRE SAUCE, BLACK PEPPER, GARLIC, PARMESAN CHEESE with letters advanced (A=1, ..., Z=26) by A, N, C, H, O, V, I, E, S respectively.

(b) PINEAPPLE UPSIDE-DOWN (CAKE). Reading from bottom to top, the initial letters of the ingredients spell out PINEAPPLE.

20.

(a) letters advanced by successive digits in the year (repeated e.g. 1, 9, 0, 1, 1, 9, 0, 1, ...): RDEF0 EIDUXRJB MIFT/QUEEN VICTORIA DIES (1901), XXSPE FBV J KFKJWT/WORLD WAR I BEGINS (1914), XRPTJN-VNF-YQUI YWHMRUNFM/WINNIE-THE-POOH PUBLISHED (1926), XXUUE FDA JR ENHRQB/WORLD WAR II BEGINS (1939), HJRLIR EATJWAJWEBFM/GANDHI ASSASSINATED (1948), MJNRB XWIJCX AIN JHSCM/LAIKA ORBITS THE EARTH (1957), XXUMTCULL OKBURBJM/WOODSTOCK FESTIVAL (1969), FUCPT YYLTULF ERLZ/ELVIS PRESLEY DIES (1977), CNZUJW EJMU NJMUA/BERLIN WALL FALLS (1989), NJWHFUJ FFLXQFB YVFBRHFWC/MANDELA BECOMES PRESIDENT (1994)

(b) TRADITIONAL ROMAN BREVIARY (the encipherment phrase): MATINS/YTPMCK, LAUDS/VTQDK, PRIME/GJMYI, TERCE/PIJAI, SEXT/KIWP, NONE/CFCI, VESPER/SIKGIJK, COMPLINE/AFYGV MCI

Plaintext: ABCDEFGHIJKLMNOPQRSTUVWXYZ
 Cipher: TRADIONLMBEVYCFGHJKPQSUXZ

(c) words contain the abbreviation of one and only one month: NIGHTJAR/JAN, BONFIRE/FEB, WATCHMAKER/MAR, CATERPILLAR/APR, SYMPATHY/MAY, SUBJUNCTIVE/JUN, BEAUJOLAIS/JUL, GAUCHO/AUG, WHISPER/SEP, AGNOSTIC/OCT, TELEVISION/NOV, ARCHDEACON/DEC

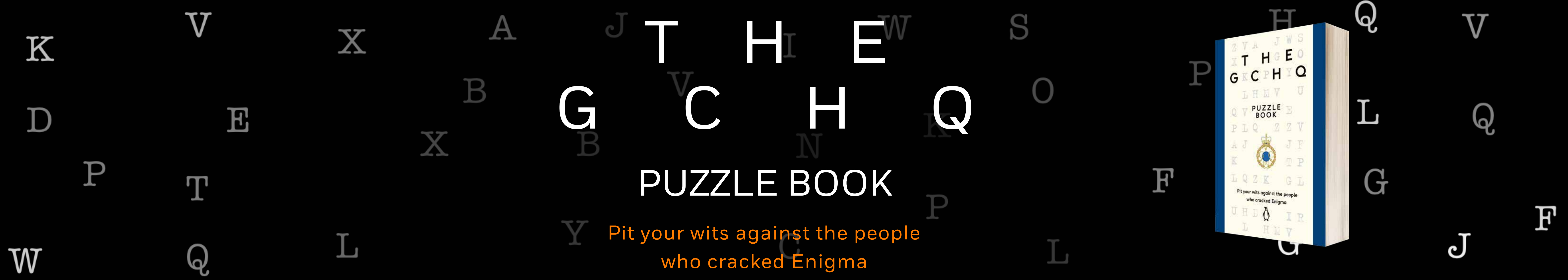
21. The words before the colon are all found in the concatenated string formed from the names of letters of an alphabet. The word after the colon is found in that string reversed. The alphabets are:

- (a) Greek (KAPPA/LAMBDA, CHI/PSI, LAMBDA, GAMMA/DELTA, SIGMA/TAU, OMICRON, EPSILON, BETA/GAMMA, ETA/THETA, THETA: DELTA/EPSILON)
- (b) NATO phonetic (OSCAR/PAPA, SIERRA/TANGO, UNIFORM, WHISKEY, HOTEL, MIKE/NOVEMBER, CHARLIE/DELTA, ROMEO/SIERRA, XRAY, VICTOR; MIKE/NOVEMBER)
- (c) Hebrew (KAF/LAMED, DALET, QOF/RESH, SAMEKH/AYIN, SHIN/TAV, LAMED, DALET, GIMEL/DALET, TSADI, DALET/HE; PE/TSADI)

22. The sequences consist of the first 10 numbers which have letters in common with ONE, TWO, ..., NINE. The first 10 numbers that have letters in common with TEN are:

1, 2, 3, 5, 7, 8, 9, 10, 11, 12, ...

23. SNORCIMO. The sequence is the 5 consecutive Greek letters MU, NU, XI, OMICRON and PI reversed with S prepended.



24. The letters in the name of the author/composers/director/performer of the works have been removed from the works.

(a) CHARLES JOHN HUFFAM DICKENS: A TALE OF TWO CITIES, BARNABY RUDGE, BLEAK HOUSE, DAVID COPPERFIELD, DOMBEY AND SON, GREAT EXPECTATIONS, HARD TIMES, LITTLE DORRIT, MARTIN CHUZZLEWIT, NICHOLAS NICKLEBY, OLIVER TWIST, OUR MUTUAL FRIEND, THE MYSTERY OF EDWIN DROOD, THE OLD CURIOSITY SHOP, THE PICKWICK PAPERS

(b) GILBERT AND SULLIVAN: HMS PINAFORE, IOLANTHE, PATIENCE, PRINCESS IDA, RUDDIGORE, THE GONDOLIERS, THE MIKADO, THE PIRATES OF PENZANCE, THE SORCERER, THE YEOMEN OF THE GUARD, THESPIS, TRIAL BY JURY

(c) ALFRED JOSEPH HITCHCOCK: DIAL M FOR MURDER, FOREIGN CORRESPONDENT, MARNIE, NORTH BY NORTHWEST, PSYCHO, REAR WINDOW, REBECCA, SPELLBOUND, STRANGERS ON A TRAIN, SUSPICION, THE BIRDS, THE MAN WHO KNEW TOO MUCH, THE TROUBLE WITH HARRY, THE WRONG MAN, TO CATCH A THIEF, TOPAZ, TORN CURTAIN, UNDER CAPRICORN, VERTIGO

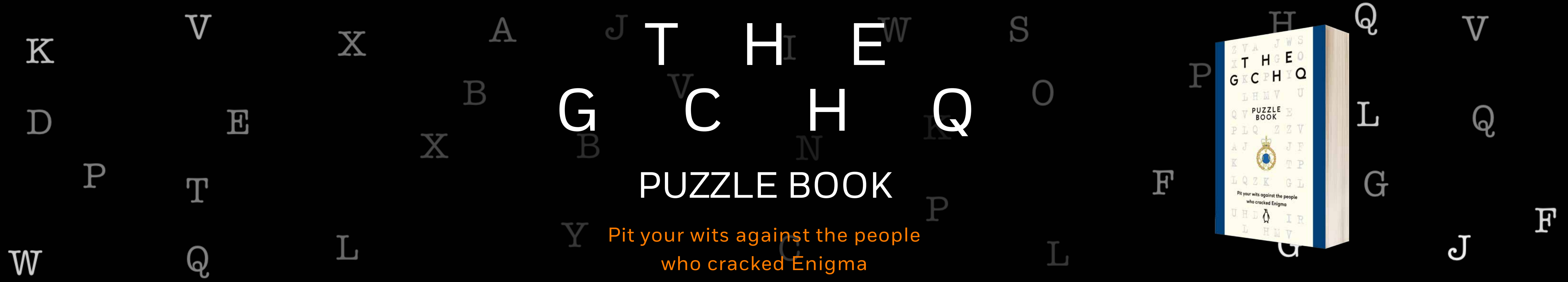
(d) THE ROLLING STONES: ALL DOWN THE LINE, ANGIE, AS TEARS GO BY, COME ON, FOOL TO CRY, GIMME SHELTER, ITS ALL OVER NOW, LIKE A ROLLING STONE, LITTLE RED ROOSTER, OUT OF TIME, STREET FIGHTING MAN, THE LAST TIME

25.

(a) Same in Morse Code: BELARUS/DEFICITS (-.....-....-....-....), BENIN/TIFF (-.....-....-), ESTONIA/HOTTEST (.....-----.....-), FIJI/USAGE (...-.....-----), GREECE/MERITED (--..-.....-....), HAITI/SERENE (.....-....-), INDIA/ERNEST (...-.-.....-), IRAN/STEP (...-.-....-), NEPAL/DEMURE (-....-....-....), NIUE/DEER (-.....-.)

(b) Complementary (. ↔ -) in Morse Code: INDIA/GNOME (...-.-.....-/-....-.....-), MALTA/INTAKE (--..-.....-/-....-.....-), NIGER/AGAMA (-....-.....-/.---..---.), OMAN/SIX (-----..-/......-....), PERU/DOWN (.---..-.....-/-....-.....-), SAMOA/OTHER (.....-----.-/-----.....-), SERBIA/MORMON (.....-.-.....-/-.....-.....-), TOGO/ISLE (-----..-/......-....), UKRAINE/GETAWAY (...-.-.....-/-....-.....-), YEMEN/RAFT (-....-.....-/.---..---.)

(c) Reversals in Morse Code: ERITREA/DETAIL (...-.....-.....-/-....-.....-), GAMBIA/DEVOUT (--..-.....-/-....-.....-), INDIA/DIAL (...-.-.....-/-.....-.-....), IRAN/WIDE (...-.-....-/.---..---.), LATVIA/DENIZEN (.---..-.....-....-/-....-.....-), MALTA/CRY (--..-.....-/-....-.....-), NIUE/REST (...-.-.....-/.---..---.), RUSSIA/BEHAVE (.---..-.....-/-....-.....-), SAMOA/NOOSE (.....-----.-/-.....-.....-), SUDAN/WEIGH (.....-----.-/.....-.....-.....-)



26.

(a) After 6. The order is the alphabetic order of the cardinals 1-56 expressed in words, the letters in each word first having being sorted in alphabetic order: 17/SEVENTEEN/EEEEENNSTV, 18/EIGHTEEN/EEEGHINT, 23/TWENTY THREE/EEEHNRTTTWY, ..., 32/THIRTY TWO/HIORTTTWY, 30/THIRTY/HIRTTY, 6/SIX/ISX, **2/TWO/OTW**

(b) Between 7 and 20. The order is the alphabetic order of the squares of the cardinals 1-56 expressed in words: 29/EIGHT HUNDRED AND FORTY ONE, 9/EIGHTY ONE, 24/FIVE HUNDRED AND SEVENTY SIX, ..., 7/FORTY NINE, **2/FOUR**, 20/FOUR HUNDRED, ..., 51/TWO THOUSAND SIX HUNDRED AND ONE, 48/TWO THOUSAND THREE HUNDRED AND FOUR, 47/TWO THOUSAND TWO HUNDRED AND NINE

(c) Between 3 and 31. The order is the alphabetic order of the elements with atomic numbers 1-56, each element first reversed: 33/ARSENIC/CINESRA, 30/ZINC/CNIZ, 53/IODINE/ENIDOI, ..., 3/LITHIUM/MUIHTIL, **2/HELIUM/MUILEH**, 31/GALLIUM/MUILLAG, ..., 15/PHOSPHORUS/SUROHPSOHP, 27/COBALT/TLABOC, 51/ANTIMONY/YNOMITNA,

27. 10.0×100 . The missing item must: use the * operator; have (the) first number ending in .0; evaluate to a 4-digit integer; have the same digits in the first and second numbers; and evaluate to the cube of an integer.

operator

A	B	G	J	25×1	1×3	16×31	???	*
C	D	E	M	$0 + 8$	$11 + 11$	$1024 + 11$	$35.0 + 806$	+
F	N	O	P	$1056.0 / 16$	$9801 / 1089$	$5D091 / 1111$	$14020800 / 1725$	/
H	I	K	L	$19DA - 57$	$121 - 94$	$117.0 - 111$	$925 - 259$	-

first number

A	C	L	P	25	0	925	14020800	multiple of 25
B	D	H	O	1	11	19DA	5D091	Hexadecimal
E	G	I	N	1024	16	121	9801	Square
F	J	K	M	1056.0	???	117.0	35.0	ends .0

evaluated expression

A	D	F	I	25	28	66.0	27	2-digit integer
B	C	K	N	3	8	6.0	9	1-digit integer
E	H	J	P	1035	6561	???	8128	4-digit integer
G	L	M	O	496	666	841.0	343	3-digit integer

second number

A	E	K	O	1	11	111	1111	all 1's
B	I	M	P	3	94	806	1725	all of 0-9 used
C	F	G	H	8	16	31	57	(see note below)
D	J	L	N	11	???	259	1089	same digits as first

evaluated expression

A	H	M	N	25	6561	841.0	9	Square
B	E	F	L	3	1035	66.0	666	triangular number
C	I	J	O	8	27	???	343	Cube
D	G	K	P	28	496	6.0	8128	perfect number

These are the number of pieces that a cake is divided into by 4, 5, 6, 7 cuts respectively (see Moser's Circle Theorem).

Scoring notes: award yourself half a mark for each theme spotted, plus half a mark for getting the right answer.

28.

- (a) AC/DC. (*AC/DC base 16 = 172/220 = 43/55 base 10 = 2B/37 base 16.*)
- (b) John Cage. (*He 'composed' the piece 4'33". (0°)4'33" is 91π/216000 radians.*)

29. WIZARD. The encryption rule is to reverse the word and substitute each letter by its complement in the alphabet (i.e. A → Z, B → Y, . . . , Z → A). The text thus reads:

"You wake up in the marvellous OZ. Later you are joined by a SCARECROW, a TIN WOODMAN and a LION."

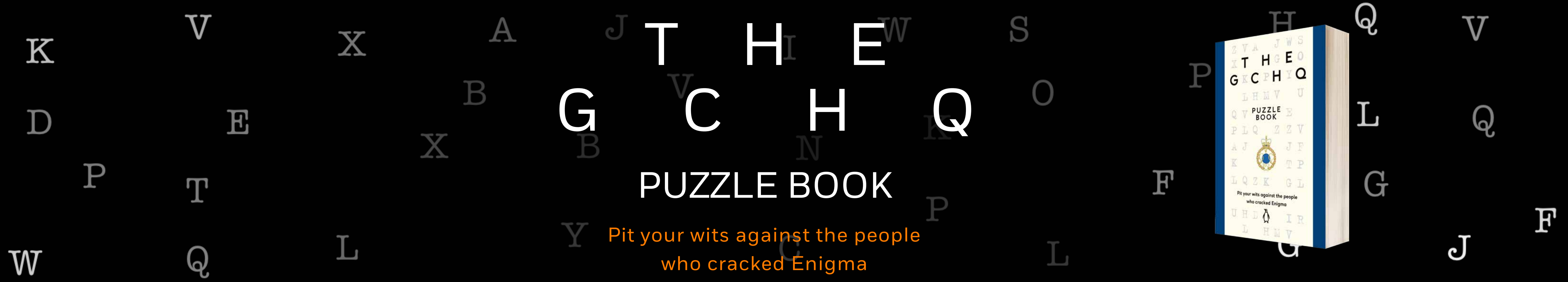
So, we'll all go off to see the WIZARD. (Magically, WIZARD is unaffected by encryption.)

30. e. Reading the sequence as 11, treble 11, 11, outer bull, inner bull, outer bull, 6, treble 6, 6, (doubles 6, 13, 4, 18, 1, 20, 5, 12, 9, 14, 11, 8, 16, 7, 19, 3, 17, 2), these are - in order - the 'scores' that are encountered in tracing the letter on a dartboard:

					20				
				5		1			
			12				18		
		9						4	
	14								13
11					25	50	25		6
	8								10
		16						15	
			7						2
				19		17			
					3				

31. LEAD. The numbers represent the positions of the letters L, E, A, D within each of the first 10 elements:

HYDROGEN, HELIUM, LITHIUM, BERYLLIUM, BORON, CARBON, NITROGEN, OXYGEN,
 FLUORINE, NEON
 HYDROEN, HELIUM, LITHIUM, BERYLLIUM, BORON, CARBON, NITROEN, OXYEN,
 FLUORINEE, NEON
 HYDROGEN, HELIUM, LITHIUM, BERYLLIUM, BORON, CARBON, NITROGEN, OXYGEN,
 FLUORINE, NEON
 HDROGEN, HELIUM, LITHIUM, BERYLLIUM, BORON, CARBON, NITROGEN, OXYGEN,
 FLUORINE, NEON



32.

(a) END. The list of English words is then an anagram of the list of French numerals UN, DEUX, TROIS, QUATRE, CINQ, SIX, SEPT, HUIT, NEUF, DIX.

(b) FIN. The list of French words is then an anagram of the list of English numerals ONE, TWO, THREE, FOUR, FIVE, SIX, SEVEN, EIGHT, NINE, TEN.

33. NINE THOUSAND. The phrase is formed from the 100 Scrabble™ tiles, with the space tiles being used for a P and an H.

34. (g). All others are correct where addition is of the elements' symbols, base 36.

(a) ALUMINIUM(AL/381) + EINSTEINIUM(ES/532) = PALLADIUM(PD/913)

(b) BROMINE(BR/423) + URANIUM(U/30) = CHLORINE(CL/453)

(c) COBALT(CO/456) + GOLD(AU/390) = NICKEL(NI/846)

(d) DYSPROSIUM(DY/502) + GOLD(AU/390) = OSMIUM(OS/892)

(e) EINSTEINIUM(ES/532) + COPERNICIUM(CN/455) = RUTHERFORDIUM(RF/987)

(f) FRANCIUM(FR/567) + BERKELIUM(BK/416) = RUBIDIUM(RB/983)

(g) GALLIUM(GA/586) - TUNGSTEN(W/32) = IRON(FE/554)

(h) HELIUM(HE/626) + SILVER(AG/376) = RUTHENIUM(RU/1002)

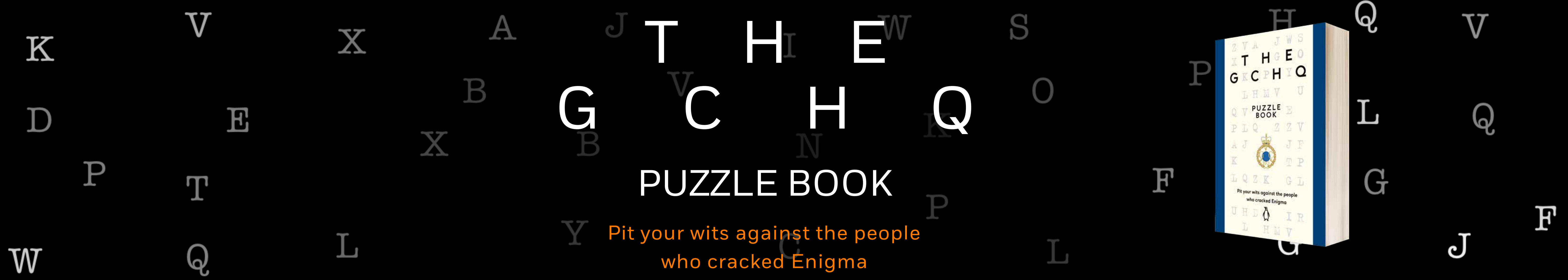
(i) IRON(FE/554) + SILVER(AG/376) = PLUTONIUM(PU/930)

35. 57. The numbers are the products of consecutive numbers on a dartboard: $20 = 20 \times 1$, $18 = 1 \times 18$, $72 = 18 \times 4$, $52 = 4 \times 13$, $78 = 13 \times 6$, $60 = 6 \times 10$, $150 = 10 \times 15$, $30 = 15 \times 2$, $34 = 2 \times 17$, $51 = 17 \times 3$, $57 = 3 \times 19$

36.

(a) As consecutive letters in the US States, listed alphabetically and concatenated: ALABAMA, ALASKA, ARIZONA, ARKANSAS, CALIFORNIA, COLORADO, CONNECTICUT, DELAWARE, FLORIDA, GEORGIA, HAWAII, IDAHO, ILLINOIS, INDIANA, IOWA, KANSAS, KENTUCKY, LOUISIANA, MAINE, MARYLAND, MASSACHUSETTS, MICHIGAN, MINNESOTA, MISSISSIPPI, MISSOURI, MONTANA, NEBRASKA, NEVADA, NEW HAMPSHIRE, NEW JERSEY, NEW MEXICO, NEW YORK, NORTH CAROLINA, NORTH DAKOTA, OHIO, OKLAHOMA, OREGON, PENNSYLVANIA, RHODE ISLAND, SOUTH CAROLINA, SOUTH DAKOTA, TENNESSEE, TEXAS, UTAH, VERMONT, VIRGINIA, WASHINGTON, WEST VIRGINIA, WISCONSIN, WYOMING

(b) As consecutive letters in the shipping forecast areas, in the order read by the BBC, and concatenated: VIKING, NORTH UTSIRE, SOUTH UTSIRE, FORTIES, CROMARTY, FORTH, TYNE, DOGGER, FISHER, GERMANBIGHT, HUMBER, THAMES, DOVER, WIGHT, PORTLAND, PLYMOUTH, BISCAY, TRAFALGAR, FITZROY, SOLE, LUNDY, FASTNET, IRISHSEA, SHANNON, ROCKALL, MALIN, HEBRIDES, BAILEY, FAIRISLE, FAEROES, SOUTHEAST, ICELAND



37.

(a) 135. The numbers represent the position of the vowels in the English language cardinal numbers: ONE, TWO, THREE, FOUR, FIVE, SIX, SEVEN, EIGHT, NINE, TEN, ELEVEN.

(b) 2458. The numbers represent the position of the vowels in the words in the question: WHAT, IS, THE, NEXT, NUMBER, IN, EACH, OF, THE, FOLLOWING, SEQUENCES.

38.

(a) After JACKAL. The mammals are ordered by their Scrabble™ score, with an alphabetical tie-break: LION (4), CAT (5), RAM (5), BULL (6), PIG (6), HARE (7), HORSE (8), ELEPHANT (13), IBEX (13), DONKEY (14), GIRAFFE (14), ORYX (14), GAZELLE (17), JACKAL (19), **HIPPOPOTAMUS (23)**

(b) Between HARE and RAM. The mammals are ordered by their alphabetically sorted form: JACKAL (AACJKL), CAT (ACT), GAZELLE (AEEGLLZ), ELEPHANT (AEEHLNPT), GIRAFFE (AEFFGIR), HARE (AEHR), **HIPPOPOTAMUS (AHIMOOPPPSTU)**, RAM (AMR), IBEX (BEIX), BULL (BLLU), DONKEY (DEKNOY), HORSE (EHORS), PIG (GIP), LION (ILNO), ORYX (ORXY)

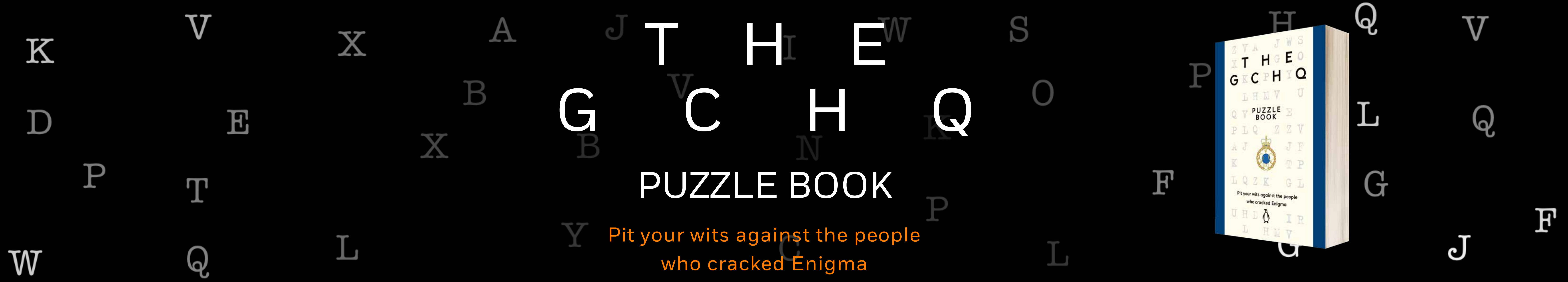
(c) Between LION and ELEPHANT. The mammals are ordered by their Gardiner Number (Egyptian Hieroglyphs): BULL (E1), HORSE (E6), DONKEY (E7), RAM (E10), PIG (E12), CAT (E13), JACKAL (E17), LION (E22), **HIPPOPOTAMUS (E25)**, ELEPHANT (E26), GIRAFFE (E27), ORYX (E28), GAZELLE (E29), IBEX (E30), HARE (E34)

39. EIRE, SYRIA, ZIMBABWE, ZAMBIA. The 'instructions' are

- N: delete the letter at position N
- +N: insert A at position N
- (M, N): exchange the letters at positions M and N
- N+: replace the letter at position N by its successor in the alphabet
- N-: replace the letter at position N by its predecessor in the alphabet

So, for example, following the instructions one at a time

GREECE → GREEC → GREE → ERGE → EGRE → EHRE → EIRE



40. Columns E(nglish), F(rench), G(erman) originally contained the positive cardinal numbers in that language with no duplicate letters:

E: 1/ONE, 2/TWO, 4/FOUR, 5/FIVE, 6/SIX, 8/EIGHT, 10/TEN, 40/FORTY, 46/FORTY SIX, 60/SIXTY, 61/SIXTY ONE, 64/SIXTY FOUR, 80/EIGHTY, 84/EIGHTY FOUR, **5000/FIVE THOUSAND**

F: 1/UN, 2/DEUX, 3/TROIS, 4/QUATRE, 5/CINQ, 6/SIX, 7/SEPT, 8/HUIT, 9/NEUF, 10/DIX, 11/ONZE, 12/DOUZE, 14/QUATORZE, 15/QUINZE, 17/DIX-SEPT, 19/DIX-NEUF, 20/VINGT, 22/VINGT-DEUX, 60/SOIXANTE, **110/CENT DIX**

G: 1/EINS, 2/ZWEI, 3/DREI, 4/VIER, 8/ACHT, 10/ZEHN, 11/ELF, 12/ZWÖLF, 60/SECHZIG, 80/ACHTZIG, ..., **12000/ZWÖLFTAUSEND**

41. WE WISH YOU A MERRY CHRISTMAS. The first letters of each word (reading left to right, top to bottom) in the list spell out THE MISSING LYRICS FROM THE SETTERS. The third letters similarly give GCCDCBAAADDEDCBGGEEFEDCAGGADBC, the notes that begin WE WISH YOU A MERRY CHRISTMAS.

How did you do? If you scored over 90 marks then that puts you alongside only a handful of GCHQ teams. If you scored more than 50 marks then you have done very well. However any score at all is good – this is a hard kwiz!