

# Cryptography Challenge

## Introduction

The names of five exhibits in the National Museum of Scotland have been encrypted as secret messages below. Each one has been encrypted using a different cipher. Can you crack the code?

### Clue 1 – Atbash Cipher

Fill in the table below by writing out the alphabet backward underneath. Use this key to find the message.

|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |
|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   | c | b | a |

ENCRYPTED MESSAGE:

ovdrh xsvhhnvm

DECRYPTED MESSAGE:

This cipher gets its name from the Hebrew alphabet. The first letter of the Hebrew alphabet is “aleph”, which gets encrypted to the last letter, “taw”. The second letter of the Hebrew alphabet is “bet”, which gets encrypted to the second-last letter, “shin”. Putting these four letters together gives something which sounds like “atbash”.

### Clue 2 – Pigpen Cipher

Each letter is coded using the grid shape surrounding it. Here is the key:

|   |   |   |   |   |   |
|---|---|---|---|---|---|
| A | B | C | J | K | L |
| D | E | F | M | N | O |
| G | H | I | P | Q | R |

|              |              |
|--------------|--------------|
| <del>S</del> | <del>W</del> |
| <del>T</del> | <del>X</del> |
| <del>V</del> | <del>Y</del> |
| <del>U</del> | <del>Z</del> |

A=┌ B=┐ C=└ M=⊞ U=∧ etc.

ENCRYPTED MESSAGE:



DECRYPTED MESSAGE:

This cipher is sometimes known as the “Freemason’s cipher” because it was often used by the Freemasons. You can see examples of this cipher on some tombstones of people who were Freemasons.

### Clue 3 – Polybius Square

Polybius square – Each letter is encoded as a pair of digits, using the square below. We always go **across first**, then **down second**. So the word “EXAMPLE” is coded as 23454224113123.

|        |   |     |   |   |   |   |
|--------|---|-----|---|---|---|---|
| E – 23 |   | 1   | 2 | 3 | 4 | 5 |
| X – 45 | 1 | P   | O | L | Y | B |
| A – 42 | 2 | I/J | U | S | A | C |
| M – 24 | 3 | D   | E | F | G | H |
| P – 11 | 4 | K   | M | N | Q | R |
| L – 31 |   |     |   |   |   |   |
| E – 23 | 5 | T   | V | W | X | Z |

ENCRYPTED MESSAGE:

**1321313141 155323 3253232311**

DECRYPTED MESSAGE:

This cipher is named after the Ancient Greek historian, Polybius. You can see his name appearing as the “keyword” in the encryption square, but you can use any other word with no repeated letters. Can you make up your own cipher using your own secret keyword?

## Clue 4 – Digraph Cipher

Each pair of letters (a digraph) is encrypted using the table below. Don't forget to go **across first, then down!**

To encrypt the word EXAMPLE, we split the word into digraphs "EX AM PL EX". Note we add an extra letter "X" to the end to make sure

we have pairs of letters. Using the table, we get: **EX – GV** and **AM – VR** and **PL – UG** and **EX – GV**. So "EXAMPLE" encrypts to "GVVRUGGV".

To decrypt this message, you need to do the opposite. Find the pairs of letters and then look **up first and across second**.

|   | 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 | JR | JS | JT | JU | JV | JW | JX | JY | JZ | JA | JB | JC | JD | JE | JF | JG | JH | JI | JJ | JK | JL | JM | JN | JO | JP | JQ |
| B | KR | KS | KT | KU | KV | KW | KX | KY | KZ | KA | KB | KC | KD | KE | KF | KG | KH | KI | KJ | KK | KL | KM | KN | KO | KP | KQ |
| C | LR | LS | LT | LU | LV | LW | LX | LY | LZ | LA | LB | LC | LD | LE | LF | LG | LH | LI | LJ | LK | LL | LM | LN | LO | LP | LQ |
| D | MR | MS | MT | MU | MV | MW | MX | MY | MZ | MA | MB | MC | MD | ME | MF | MG | MH | MI | MJ | MK | ML | MM | MN | MO | MP | MQ |
| E | NR | NS | NT | NU | NV | NW | NX | NY | NZ | NA | NB | NC | ND | NE | NF | NG | NH | NI | NJ | NK | NL | NM | NN | NO | NP | NQ |
| F | OR | OS | OT | OU | OV | OW | OX | OY | OZ | OA | OB | OC | OD | OE | OF | OG | OH | OI | OJ | OK | OL | OM | ON | OO | OP | OQ |
| G | PR | PS | PT | PU | PV | PW | PX | PY | PZ | PA | PB | PC | PD | PE | PF | PG | PH | PI | PJ | PK | PL | PM | PN | PO | PP | PQ |
| H | QR | QS | QT | QU | QV | QW | QX | QY | QZ | QA | QB | QC | QD | QE | QF | QG | QH | QI | QJ | QK | QL | QM | QN | QO | QP | QQ |
| I | RR | RS | RT | RU | RV | RW | RX | RY | RZ | RA | RB | RC | RD | RE | RF | RG | RH | RI | RJ | RK | RL | RM | RN | RO | RP | RQ |
| J | SR | SS | ST | SU | SV | SW | SX | SY | SZ | SA | SB | SC | SD | SE | SF | SG | SH | SI | SJ | SK | SL | SM | SN | SO | SP | SQ |
| K | TR | TS | TT | TU | TV | TW | TX | TY | TZ | TA | TB | TC | TD | TE | TF | TG | TH | TI | TJ | TK | TL | TM | TN | TO | TP | TQ |
| L | UR | US | UT | UU | UV | UW | UX | UY | UZ | UA | UB | UC | UD | UE | UF | UG | UH | UI | UJ | UK | UL | UM | UN | UO | UP | UQ |
| M | VR | VS | VT | VU | VV | VW | VX | VY | VZ | VA | VB | VC | VD | VE | VF | VG | VH | VI | VJ | VK | VL | VM | VN | VO | VP | VQ |
| N | WR | WS | WT | WU | WV | WW | WX | WY | WZ | WA | WB | WC | WD | WE | WF | WG | WH | WI | WJ | WK | WL | WM | WN | WO | WP | WQ |
| O | XR | XS | XT | XU | XV | XW | XX | XY | XZ | XA | XB | XC | XD | XE | XF | XG | XH | XI | XJ | XK | XL | XM | XN | XO | XP | XQ |
| P | YR | YS | YT | YU | YV | YW | YX | YY | YZ | YA | YB | YC | YD | YE | YF | YG | YH | YI | YJ | YK | YL | YM | YN | YO | YP | YQ |
| Q | ZR | ZS | ZT | ZU | ZV | ZW | ZX | ZY | ZZ | ZA | ZB | ZC | ZD | ZE | ZF | ZG | ZH | ZI | ZJ | ZK | ZL | ZM | ZN | ZO | ZP | ZQ |
| R | AR | AS | AT | AU | AV | AW | AX | AY | AZ | AA | AB | AC | AD | AE | AF | AG | AH | AI | AJ | AK | AL | AM | AN | AO | AP | AQ |
| S | BR | BS | BT | BU | BV | BW | BX | BY | BZ | BA | BB | BC | BD | BE | BF | BG | BH | BI | BJ | BK | BL | BM | BN | BO | BP | BQ |
| T | CR | CS | CT | CU | CV | CW | CX | CY | CZ | CA | CB | CC | CD | CE | CF | CG | CH | CI | CJ | CK | CL | CM | CN | CO | CP | CQ |
| U | DR | DS | DT | DU | DV | DW | DX | DY | DZ | DA | DB | DC | DD | DE | DF | DG | DH | DI | DJ | DK | DL | DM | DN | DO | DP | DQ |
| V | ER | ES | ET | EU | EV | EW | EX | EY | EZ | EA | EB | EC | ED | EE | EF | EG | EH | EI | EJ | EK | EL | EM | EN | EO | EP | EQ |
| W | FR | FS | FT | FU | FV | FW | FX | FY | FZ | FA | FB | FC | FD | FE | FF | FG | FH | FI | FJ | FK | FL | FM | FN | FO | FP | FQ |
| X | GR | GS | GT | GU | GV | GW | GX | GY | GZ | GA | GB | GC | GD | GE | GF | GG | GH | GI | GJ | GK | GL | GM | GN | GO | GP | GQ |
| Y | HR | HS | HT | HU | HV | HW | HX | HY | HZ | HA | HB | HC | HD | HE | HF | HG | HH | HI | HJ | HK | HL | HM | HN | HO | HP | HQ |
| Z | IR | IS | IT | IU | IV | IW | IX | IY | IZ | IA | IB | IC | ID | IE | IF | IG | IH | II | IJ | IK | IL | IM | IN | IO | IP | IQ |

ENCRYPTED MESSAGE:

**AKYRJIWZ AKJVDJNI**

DECRYPTED MESSAGE:

