Build each pattern before answering.

1 A pattern has n yellow cubes in a line, with a cube either side of each yellow one, and 5 more cubes that are always there. Pattern 1 has 7 of the side cubes, pattern 2 has 9, pattern 3 has 11.

(a) How many side cubes in pattern 4? (1)

(b) Write down the nth term for the side cubes (1)

(c) Justify your rule by describing the pattern (2)

(4 marks)

2 A staircase is made of columns of cubes, each 3 cubes high. Pattern n has n columns.

(a) How many cubes in patterns 1, 2 and 3? (1)

(b) Write down the nth term (1)

(c) One cube is now added on top of the first column, in every pattern. Write the new nth term. (1)

(d) Explain what changed in the rule and why (2)

(5 marks)

3 A pattern is made of 2 rows of cubes, each as long as the pattern number. Count two things: T_n, the total number of cubes, and E_n, the number of cubes on the two ends.

(a) Complete for patterns 1, 2 and 3: the values of T_n (1)

(b) Complete for patterns 1, 2 and 3: the values of E_n (1)

(c) Write down the rule for T_n (1)

(d) Write down the rule for E_n (1)

(4 marks)

4 A pupil says the rule for a pattern is $4n$, because four cubes are added each time. The patterns have 6, 10 and 14 cubes.

(a) Is the pupil right that four cubes are added each time? (1)

(b) Work out $4n$ for patterns 1, 2 and 3 (1)

(c) Write down what the pupil left out (2)

(d) Write the correct rule (1)

(5 marks)

5 Describe a cube pattern that would have each rule.

(a) $2n + 4$ (2)

(b) $7n$ (2)

(4 marks)