

7 **Table 4** shows some successive ionisation energy data for atoms of three different elements **X**, **Y** and **Z**.

Elements **X**, **Y** and **Z** are Ca, Sc and V but not in that order.


Table 4


	First	Second	Third	Fourth	Fifth	Sixth
X	648	1370	2870	4600	6280	12 400
Y	590	1150	4940	6480	8120	10 496
Z	632	1240	2390	7110	8870	10 720

For questions 7.1 and 7.2, only **one** answer per question is allowed.

For each answer, completely fill in the circle alongside the appropriate answer.

CORRECT METHOD  WRONG METHODS    

If you want to change your answer you must cross out your original answer as shown. 

If you wish to return to an answer previously crossed out, ring the answer you now wish to select as shown. 

0 7 . 1 Which element is calcium?

[1 mark]

X

Y

Z

0 7 . 2 Which element is vanadium?

[1 mark]

X

Y

Z

0 7 . 3 Justify your choice of vanadium in Question 7.2

[1 mark]

0 7 . 4 An acidified solution of NH_4VO_3 reacts with zinc.

Explain how observations from this reaction show that vanadium exists in at least two different oxidation states.

[2 marks]

Question 7 continues on the next page

0 7 . 5 The vanadium in 50.0 cm^3 of a $0.800 \text{ mol dm}^{-3}$ solution of NH_4VO_3 reacts with 506 cm^3 of sulfur(IV) oxide gas measured at $20.0 \text{ }^\circ\text{C}$ and 98.0 kPa .

Use this information to calculate the oxidation state of the vanadium in the solution after the reduction reaction with sulfur(IV) oxide.

Explain your working.

The gas constant $R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$.

[6 marks]

Oxidation state = _____