

Practice exam questions for Chapter 5: Atoms (Paper-saver version)

Question 1 (Bursary 2000 Question 2)

Vanadium is a transition metal.

- a** Complete the electron configuration of vanadium. A [Ar]
- b** What is the highest possible oxidation state for vanadium? A
Justify your answer. M
- c** Explain why vanadium exists in the +2 oxidation state in some compounds? M
- d** In acidic solution V_2O_5 forms the yellow VO_2^+ ion. The VO_2^+ ion can be reduced by zinc in the presence of (concentrated) hydrochloric acid to the violet $[V(H_2O)_6]^{2+}$ ion.
Give TWO characteristics of transition metal compounds that are illustrated in the above description.
A M

Question 2 (Bursary 2000 Question 11)

- a** For each of the following pairs, select the species that has the larger radius. A
Justify your answers in terms of atomic structure. M
- i** S or S^{2-}
- ii** O^{2-} or S^{2-}
- b** For the following pair, select the species that has the larger ionisation energy. A
S or Cl
Justify your answer in terms of atomic structure. M

Question 3 (Bursary 2001 Question 1)

- a** Write the **symbol** of an element from the first 36 elements of the periodic table that matches each description below. (There may be more than one correct answer but only one is required.) A M
Choose an element that is:
- i** in row 3 of the periodic table and forms an acidic oxide
- ii** a non-metal and a liquid at 25 °C
- iii** able to exist in the +7 oxidation state
- iv** a transition metal with only one electron in the 4s orbital
- v** the most electronegative element
- vi** able to form an oxyanion XO_4^{3-} .

b Write *s*, *p*, *d* electron configurations for: A M

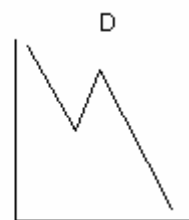
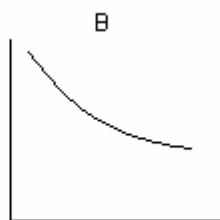
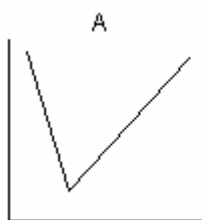
i P

ii Zn^{2+}

c i Write the equation for the reaction for which the energy change is the first ionisation energy of magnesium. A M

ii Is this reaction endothermic or exothermic? A

d



i Select the letter of the graph that represents the general trend in ionisation energy from Na to Ar. A

ii Select the letter of the graph that represents the general trend in atomic radius from Na to Ar. A

iii Justify your answer to **ii** above in terms of atomic structure. A M

e Explain why transition metals:

i often form coloured compounds A M

ii have many oxidation states A