

1. Atomic Structure

1.3 Electrons, energy levels and atomic orbitals

Paper 1

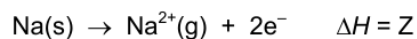
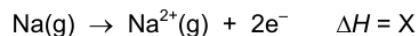
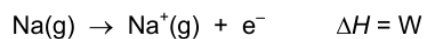
Question Paper

- 1** In which pairs are **both** species free radicals?
- 1 Cl and O
 - 2 Cl^- and O^{2-}
 - 3 Cl and O^-
 - 4 Cl^+ and O^{2+}
- A** 1, 3 and 4 **B** 1 and 3 only **C** 1 only **D** 2 only
- 2** Which species is a free radical?
- A** He **B** Be^- **C** O^{2-} **D** Zn
- 3** Which statement about the electrons in a ground state carbon atom is correct?
- A** Electrons are present in four different energy levels.
- B** There are more electrons in p orbitals than there are in s orbitals.
- C** The occupied orbital of highest energy is spherical.
- D** The occupied orbital of lowest energy is spherical.
- 4** Which atom has its outermost electron in an orbital of the shape shown, with principal quantum number 3?



- A** sodium
- B** chlorine
- C** calcium
- D** bromine

5 Equations involving four enthalpy changes are shown.



Which equation represents the second ionisation energy of sodium?

- A** X **B** X + Y – W **C** X – W **D** Z – W

6 Which type of interaction exists between water molecules and metal cations in aqueous solution?

- A** dipole-dipole interactions
B hydrogen bonds
C ion-dipole interactions
D ionic bonds

7 Which atom has more unpaired electrons than paired electrons in orbitals of principal quantum number 2?

- A** carbon
B nitrogen
C oxygen
D fluorine

8 In which pair of species do both species have only one unpaired p electron?

- A** Ar⁺ and C⁻ **B** B and Ti⁺ **C** F and Ga **D** Se⁻ and Si⁻

9 Which atomic orbitals are occupied in an atom of phosphorus?

- A** 1p2s2p **B** 2s2p2d **C** 2s2p3s **D** 2p3s3d

10 In which pair does each species have the same number of unpaired electrons?




- A Al and Cu^{2+}
- B Ca and Cr^{3+}
- C Ca and Ni^{2+}
- D Fe^{3+} and O^{2-}

11 Which statement about the electrons in a ground state carbon atom is correct?

- A Electrons are present in four different energy levels.
- B There are more electrons in p orbitals than there are in s orbitals.
- C The occupied orbital of highest energy is spherical.
- D The occupied orbital of lowest energy is spherical.

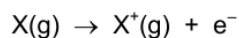
12 The outermost electron in an atom of neon occupies a particular orbital.

Which row shows the relative energy and shape of this orbital?

	energy of orbital relative to other occupied orbitals	shape of orbital
A	higher or equal	
B	higher or equal	
C	lower or equal	
D	lower or equal	

13 The eight elements sodium to argon are in the same period of the Periodic Table.

The equation corresponding to the first ionisation energy is shown.



For which of these eight elements is the electron in this equation removed from a filled orbital?

- A Mg, Al, Si, P, S, Cl and Ar
- B Al, Si, P, S, Cl and Ar only
- C Mg, S, Cl and Ar only
- D S, Cl and Ar only

14 This question refers to isolated gaseous atoms.

In which atom are all electrons paired?

A Ba

B Br

C S

D Si

15 The electronic configuration of an atom of sulfur is $1s^2 2s^2 2p^6 3s^2 3p^4$.

How many valence shell and unpaired electrons are present in one sulfur atom?

	valence shell electrons	unpaired electrons
A	2	1
B	4	2
C	6	0
D	6	2