IB Chemistry HL - S1.3

Electron configurations

Exercises + Practice questions

Official answers appended at the end

atom (see page 74).

Exercise

Q1. Emission spectra provide evidence for:

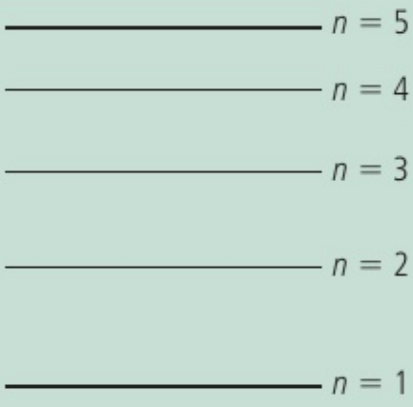
A the existence of neutrons

B the existence of isotopes

C the existence of atomic energy levels

D the nuclear model of the atom

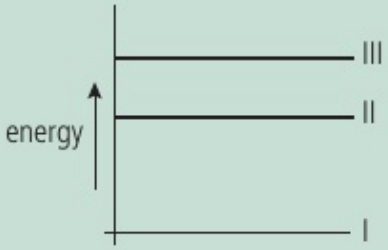
Q2. The diagram shows the lowest five electron energy levels in the hydrogen atom.



Deduce how many different frequencies in the visible emission spectrum of atomic hydrogen would arise as a result of electron transitions between these levels.

A 3 **B** 4 **C** 6 **D** 10

Q3. The diagram shows three energy levels of an atom.

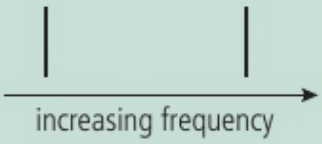


(a) Identify the transition that corresponds to the emission of light with the shortest wavelength.

A I → II **B** II → III **C** III → I **D** III → II

(b) Identify the emission line spectra that results from transitions between these energy levels.

A



B

C

D

Q4. The visible emission spectrum for hydrogen includes a red line with a wavelength of 657 nm corresponding to the transition 3 → 2. State if the transition from 4 → 2 corresponds to a higher or lower wavelength and justify your answer.

Exercise

Q5. List the 4d, 4f, 4p, and 4s atomic orbitals in order of increasing energy.

Q6. State the number of 4d, 4f, 4p, and 4s atomic orbitals.

Q7. Apply the *orbital diagram* method to determine the electron configuration of calcium.

Q8. Deduce the number of unpaired electrons present in a phosphorus atom.

Q9. Deduce the number of orbitals in the $n = 4$ level and explain your answer.

Exercise

Q10. Identify the sublevel that does not exist.

A 5d **B** 4d **C** 3f **D** 2p

Q11. Which is the correct order of orbital filling according to the Aufbau principle?

A 4s 4p 4d 4f **B** 4p 4d 5s 4f

C 4s 3d 4p 5s **D** 4d 4f 5s 5p

Q12. State the full ground-state electron configuration of the following elements.

(a) V **(b)** K **(c)** Se **(d)** Sr

Q13. Determine the total number of electrons in d orbitals in a single iodine atom.

A 5 **B** 10 **C** 15 **D** 20

Q14. Identify the excited state (i.e. not a ground state) in the following electron configurations.

A [Ne] $3s^2 3p^3$ **B** [Ne] $3s^2 3p^3 4s^1$

C [Ne] $3s^2 3p^6 4s^1$ **D** [Ne] $3s^2 3p^6 3d^1 4s^2$

Q15. Deduce the number of unpaired electrons present in the ground state of a titanium atom.

A 1 **B** 2 **C** 3 **D** 4

Q16. Identify the atom that possesses the most unpaired electrons.

A O **B** Mg **C** Ti **D** Fe

Exercise

Q17. State the full ground-state electron configuration of the following ions.

(a) O^{2-} **(b)** Cl^{-} **(c)** Ti^{3+} **(d)** Cu^{2+}

Q18. State the electron configuration of the following transition metal ions by filling in the boxes below. Use arrows to represent the electron spin.

	Ion	3d					4s
(a)	Ti^{2+}						
(b)	Fe^{2+}						
(c)	Ni^{2+}						
(d)	Zn^{2+}						

Q19. **(a)** State the full electron configuration for neon.

(b) State the formulas of two oppositely charged ions which have the same electron configuration as neon.

Q20. State the abbreviated electron configuration using the previous noble gas core for:

(a) Ni^{2+} **(b)** Pb^{2+} **(c)** S^{2-} **(d)** Si^{4+}