
HL Paper 1

Which quantities are the same for all atoms of chlorine?

- I. Number of protons
 - II. Number of neutrons
 - III. Number of electrons
- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II and III

Markscheme

B

Examiners report

[N/A]

The table below shows the number of protons, neutrons and electrons present in five species.

Species	Number of protons	Number of neutrons	Number of electrons
X	6	8	6
Y	7	7	7
Z	7	7	8
W	8	8	8
Q	8	10	8

Which **two** species are isotopes of the same element?

- A. X and W
- B. Y and Z
- C. Z and W
- D. W and Q

Markscheme

D

Examiners report

[N/A]

What is the order of increasing energy of the orbitals within a single energy level?

- A. $d < s < f < p$
- B. $s < p < d < f$
- C. $p < s < f < d$
- D. $f < d < p < s$

Markscheme

B

Examiners report

[N/A]

Which species possesses only two unpaired electrons?

- A. Zn
- B. Mg
- C. Ti^{2+}
- D. Fe^{2+}

Markscheme

C

Examiners report

[N/A]

Which species has the electron configuration of $1s^2 2s^2 2p^6 3s^2 3p^6 3d^8$?

- A. Ni
- B. Ni^{2+}
- C. Fe
- D. Cu^{2+}

Markscheme

B

Examiners report

[N/A]

Which representation would be correct for a species, **Z**, which has 31 protons, 40 neutrons and 28 electrons?

- A. ${}_{31}^{71}\text{Z}^{3+}$
- B. ${}_{31}^{71}\text{Z}^{3-}$
- C. ${}_{40}^{71}\text{Z}^{3+}$
- D. ${}_{28}^{71}\text{Z}^{3+}$

Markscheme

A

Examiners report

[N/A]

What is the correct electron configuration of the Cu^+ ion?

- A. $[\text{Ar}] 3d^9 4s^1$
- B. $[\text{Ar}] 3d^7 4s^2$
- C. $[\text{Ar}] 3d^{10}$
- D. $[\text{Ar}] 3d^8 4s^1$

Markscheme

C

Examiners report

One respondent stated that the question should not have been asked, as students are not supposed to know the Cu exception. In the teacher's notes of assessment statement 12.1.6 in the syllabus details it is clearly stated "exceptions to the principle for copper and chromium should be known".

56.49% of the candidates chose the correct answer C, with 30.78% choosing A which means that about one-third of the schools do not teach these

two exceptions.

What is the electron configuration of vanadium?

- A. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^2 4s^3$
- B. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^3 4s^2$
- C. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^4 4s^1$
- D. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5$

Markscheme

B

Examiners report

On one of the G2's it was stated that it would have been better if the 3d level was placed after the 4s level. It is true that in many textbooks that the electron configuration of V is written as $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^3$. However, most candidates (72.19%) gave B as the correct answer.

What are the numbers of neutrons and electrons in the iodine ion, $^{125}\text{I}^+$?

	Neutrons	Electrons
A.	53	53
B.	72	52
C.	72	53
D.	125	52

Markscheme

B

Examiners report

[N/A]

What is the abbreviated electron configuration of the telluride ion, Te^{2-} ?

- A. $[\text{Kr}]5s^25d^{10}5p^6$
- B. $[\text{Kr}]5s^24d^{10}5p^2$
- C. $[\text{Kr}]5s^24d^{10}5p^4$
- D. $[\text{Kr}]5s^24d^{10}5p^6$

Markscheme

D

Examiners report

[N/A]

Consider the relative abundance of the isotopes of element X.

Isotope	Relative abundance (%)
^{24}X	80
^{25}X	10
^{26}X	10

What is the relative atomic mass of X?

- A. 24
- B. 25
- C. Between 24 and 25
- D. Between 25 and 26

Markscheme

C

Examiners report

[N/A]

In the electromagnetic spectrum, which will have the shortest wavelength **and** the greatest energy?

	Shortest wavelength	Greatest energy
A.	ultraviolet	ultraviolet
B.	infrared	infrared
C.	ultraviolet	infrared
D.	infrared	ultraviolet

Markscheme

A

Examiners report

[N/A]

Which shows the sub-levels in order of **increasing** energy in the fourth energy level of an atom?

- A. $f < d < p < s$
- B. $p < d < f < s$
- C. $d < f < p < s$
- D. $s < p < d < f$

Markscheme

D

Examiners report

[N/A]

What is the electron configuration of the Cr^{2+} ion?

- A. $[\text{Ar}]3d^5 4s^1$
- B. $[\text{Ar}]3d^3 4s^1$
- C. $[\text{Ar}]3d^6 4s^1$
- D. $[\text{Ar}]3d^4 4s^0$

Markscheme

D

Examiners report

[N/A]

Which statement correctly describes the atomic emission spectrum of hydrogen?

- A. It is a continuous spectrum converging at high frequency.
- B. It is a line spectrum converging at high frequency.
- C. It is a continuous spectrum converging at low frequency.
- D. It is a line spectrum converging at low frequency.

Markscheme

B

Examiners report

[N/A]

Which electron configurations do not follow the Hund's rule?

	1s	2s	2p		
I.	↑ ↓	↑ ↓	↑	↑	↑
II.	↑ ↓	↑ ↓	↑ ↓	↑	
III.	↑ ↓	↑ ↓	↑	↓	↑

- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III

Markscheme

C

Examiners report

Many G2s and OCC forum comments were made by teachers as reference had been made to the Aufbau principle instead of just Hund's rule. This was however no problem for the students as 88% recognised that options II and III are incorrect electron configurations.

