03 Atomic Structure

Set B **Exam practice**

Name	Time 50 minutes	Total 28 marks	Score ____ / 28

Use a copy of the Periodic Table where you need one.

Marks by notes section For the marker: total each row. A score below the target means that section of the notes needs revising.

Notes section	Questions	Marks	Target	Score
1 Sub-atomic Particles	1, 2, 3, 6, 7(a), 7(c), 7(d), 7(e), 10(a)(iii), 10(b), 12	11	7	
2 Isotopes	4, 7(b), 8(c)(i), 8(c)(ii), 9, 10(a)(i), 10(a)(ii), 10(a)(iv)	12	8	
3 Electrons in Shells	5, 8(a), 8(b), 11	5	3	

A Multiple choice

6 MARKS

1 A student compared these four particles, Mg^{2+}, Ne, O^{2-} and Al^{3+}. Which conclusion about these four particles is correct?

A They are isotopes of each other.

B They have different numbers of electron shells.

C They have the same number of electrons.

D They have the same number of neutrons.

/1

Answer ☐ [1]

Source: 2026 XMS Sec 3 WA1 Q4

2 An ion, X^{2+}, has 10 electrons and 14 neutrons. What is the nucleon number of X?

A 12 **B** 16 **C** 22 **D** 26

/1

Answer ☐ [1]

Source: 2026 XMS Sec 3 WA1 Q5, adapted

3 An isotope of element Z has 20 neutrons and 17 protons. Which is the correct symbol for an ion of the isotope of element Z?

A $^{18}_{17}Z^{+}$ **B** $^{18}_{17}Z^{-}$ **C** $^{37}_{17}Z^{-}$ **D** $^{37}_{18}Z^{-}$

/1

Answer ☐ [1]

Source: 2024 CGS Sec 4 Prelim P1 Q4

4 An atom of one isotope of chlorine is represented by the symbol ^{37}Cl. Particle R has one more neutron, two more protons and one more electron than this isotope of chlorine. Which symbol represents R?

A $^{38}Cl^{+}$ **B** $^{38}Cl^{-}$ **C** ^{39}K **D** $^{40}K^{+}$

/1

Answer [1]

Source: 2025 CHIJ Sec 4 Prelim P1 Q4

5 Which ion has the most number of shells that contain electrons?

A Al^{3+} **B** Be^{2+} **C** N^{3-} **D** S^{2-}

/1

Answer [1]

Source: BLSS 2024 Sec 4 Prelim P1 Q5

6 An ion X^{2+} contains 19 neutrons and 18 electrons. Which row shows the proton number and nucleon number of X correctly?

	proton number	nucleon number
A	16	35
B	18	37
C	19	38
D	20	39

/1

Answer [1]

Source: 2020 SJI Year 3 End-of-Year P1 Q10

B Structured questions

22 MARKS

7 The table gives the number of protons, neutrons and electrons in some particles. The letters do not represent the symbols of the elements.

particle	protons	neutrons	electrons
A	17	18	18
B	17	20	17
C	17	18	17
D	16	16	16
E	16	16	18

(a) Which particles are negative ions?

..... [1]

(b) Which two atoms are isotopes?

..... [1]

(c) What is the nucleon number of particle B?

..... [1]

(d) What element is particle D?

..... [1]

(e) What is the charge of particle E?

/5

.....

[1]

Source: 2020 XMS Sec 3 WA1 B1(a), adapted

8 The table shows some information about atoms of the elements P, Q, R and S. The letters do not represent the symbols of the elements.

element	protons	neutrons	nucleon number	electronic configuration
P	16	16	32	2.8.6
Q	12	12	24	2.8.2
R	18	22		
S	17	18	35	2.8.7

(a) Complete the table by filling in the nucleon number and electronic configuration for element R.

.....

[1]

(b) Explain why element R tends to exist as single atoms.

.....

.....

[1]

(c) Another isotope of element S has a nucleon number of 37. Isotopes of elements have different physical properties but similar chemical properties.

(i) Define the term isotope.

.....

.....

[1]

(ii) Explain why the isotopes of an element have similar chemical properties.

.....

.....

[1]

/4

Source: 2020 SJI Year 3 End-of-Year P2 A3, adapted

9 Uranium exists as isotopes, uranium-235 and uranium-238. Uranium has proton number 92.

Using your knowledge of atomic structure, explain why uranium-235 and uranium-238 are isotopes. State clearly the number of sub-atomic particles to support your answer.

.....

.....

.....

.....

[3]

/3

Source: 2024 SMSS Sec 3 End-of-Year P2 Q3(a), adapted

10 There are three isotopes of hydrogen, shown in Table 10.1. Heavy water, D_2O, is water in which the hydrogen atoms are replaced by deuterium. Heavy water is used as a scientific tracer to monitor biological and chemical processes. Heavy water is chemically similar to ordinary water, and scientists can detect atoms of different masses using a technique called mass spectrometry.

isotope	protons	neutrons	electrons	nuclide notation
hydrogen	1	0	1	$^{1}_{1}H$
deuterium	1	1	1	
tritium	1	2	1	

(a) Use Table 10.1 to answer the following.

(i) Complete the nuclide notation in Table 10.1.

.....

[1]

(ii) Using Table 10.1, explain why deuterium and tritium are said to be isotopes of hydrogen.

.....

.....

.....

[2]

(iii) Explain why all three isotopes of hydrogen are electrically neutral.

.....

.....

[1]

(iv) Using your understanding of the properties of isotopes, explain why heavy water can be used as a scientific tracer to monitor biological and chemical processes.

.....

.....

.....

[2]

(b) Hydrogen can form two types of ions. Complete Table 10.2.

name of ion	chemical symbol	number of electrons
hydrogen ion	H^+	
hydride ion	H^-	

[1]

/7

Source: 2026 XMS Sec 3 WA1 Q8, adapted

11 Argon is used as a filler gas in light bulbs as it provides an inert environment and prevents unwanted reactions from happening.

Using its electronic configuration, explain why argon is able to provide an inert environment in light bulbs.

.....

.....

.....

[2]

/2

Source: 2026 XMS Sec 3 WA1 Q7(d)

12 Flerovium, Fl, has proton number 114. To make flerovium, atoms of plutonium (proton number 94) are bombarded with ions of element X. The nucleus of one atom of plutonium combines with the nucleus of one atom of element X to form the nucleus of one atom of flerovium.

Suggest the identity of element X.

.....

[1]

/1

Source: 2024 AMKSS Sec 4 Prelim P2 Q4(a), adapted