

Past-paper walk-through

Atomic structure and the Periodic Table ■ 2.2

eXercise

Questions in this set

- 0620/21 N25 Q3 ■ 1 mark
- 0620/21 N25 Q5 ■ 1 mark
- 0620/22 N25 Q5 ■ 1 mark
- 0620/23 N25 Q3 ■ 1 mark
- 0620/41 N25 Q1 ■ 13 marks
- 0620/22 J25 Q3 ■ 1 mark
- 0620/22 J25 Q4 ■ 1 mark
- 0620/41 J25 Q2 ■ 10 marks
- 0620/22 M25 Q4 ■ 1 mark

Reading the mark scheme

- **B1** a mark that stands on its own – the point is either made or not.
- **M1** a *method* mark: the right approach, even if the number is wrong.
- **A1** an *answer* mark, and it usually needs its M mark first.
- **C1** a working mark on the way to the answer.
- **//** separates answers the examiner accepts equally.
- **ecf** = error carried forward: a later part is marked on your own earlier answer.
- **owtte** = “or words to that effect” – the wording need not match.

Question 3

0620/21 N25 ■ Q3 ■ 1 mark

- 3 The table shows information about four different particles.

particle	nucleon number	number of protons	number of neutrons	number of electrons
Na	23	11	W	11
Na ⁺	23	11	12	X
O	16	8	Y	8
O ²⁻	16	8	8	Z

What are the values of W, X, Y and Z?

Question 3

	W	X	Y	Z
A	11	10	10	8
B	11	11	8	10
C	12	10	8	10
D	12	11	10	8

Solution 3

Answer: **C**

Why

- For a neutral atom, electrons = protons, and neutrons = nucleon number – protons.
- Na: $23 - 11 = 12$ neutrons; Na^+ has one electron fewer, so 10.
- O: $16 - 8 = 8$ neutrons; O^{2-} has two electrons more, so 10.

Question 5

0620/21 N25 ■ Q5 ■ 1 mark

5 Symbols representing four particles are shown.



The letters are **not** the chemical symbols.

Which particles have the same number of neutrons?

A W and X^{2+}

B W and Z

C X^{2+} and Y

D Y and Z

Solution 5

Answer: **B**

Why

- Neutrons = nucleon number – proton number.
- W: $40 - 20 = 20$. X: $41 - 20 = 21$. Y: $37 - 18 = 19$. Z: $37 - 17 = 20$.
- So W and Z both have 20 neutrons – charge makes no difference to the neutron count.

Question 5

0620/22 N25 ■ Q5 ■ 1 mark

- 5** Which statement about atoms or ions is correct?
- A** The mass number of an atom is the total number of nucleons and protons.
 - B** The electronic configuration of an aluminium ion, Al^{3+} , is 2,8,3.
 - C** Hydrogen is the only atom that has an incomplete first electron shell.
 - D** Most of the volume of an atom is taken up by its nucleus.

Solution 5

Answer: **C**

Why

- Mass number counts protons *and neutrons*, not protons twice.
- Al^{3+} has lost three electrons, so its configuration is 2, 8, not 2, 8, 3.
- The common isotope of hydrogen is the only atom with no neutron at all.

Question 3

0620/23 N25 ■ Q3 ■ 1 mark

3 Which statement defines nucleon number?

- A** It is the total number of protons in the nucleus of an atom.
- B** It is the total number of electrons surrounding the nucleus of an atom.
- C** It is the total number of neutrons in the nucleus of an atom.
- D** It is the total number of protons and neutrons in the nucleus of an atom.

Solution 3

Answer: **D**

Why

- The nucleons are the particles in the nucleus: protons and neutrons.
- So the nucleon number is the total of the two together.
- Protons alone is the *proton* number, and electrons are not in the nucleus at all.

Question 1

0620/41 N25 ■ Q1 ■ 13 marks

1 Protons, neutrons and electrons are particles found in atoms.

(a) Complete Table 1.1 to show the relative mass and relative charge of a proton, a neutron and an electron.

Table 1.1

particle	relative mass	relative charge
proton		+1
neutron		
electron	$\frac{1}{1840}$	

[2]

Question 1

(b) Some elements have many isotopes.

(i) Define the term isotopes.

Question 1

- (ii) Explain why all isotopes of the same element have the same chemical properties.

Question 1

(c) Complete Table 1.2.

Table 1.2

atom or ion	number of protons	number of neutrons	number of electrons
$^{40}_{18}\text{Ar}$	18		18
$^{32}_{16}\text{S}^{2-}$		16	
	22	28	20

[5]

(d) The term mass number is defined as the total number of protons and neutrons in the nucleus of an atom.

.....

Question 1

State the name of **one other** term which is defined as the total number of protons and neutrons in the nucleus of an atom.

Question 1

(e) Calculate the number of atoms in 2.00 g of argon.

Give your answer in standard form.

Question 1

[Total: 13]

Solution 1

(a) Mark scheme

- particle
- relative
- mass
- relative
- charge
- proton
- 1
- neutron

Solution 1

- 1
- 0 / nil
- electron
- - 1
- (1)
- (1)
- 2

Solution 1

(b)(i)

Mark scheme

- M1 atoms of the same element that have the same number of protons **M2**
- but different numbers of neutrons
- 2

Solution 1

(b)(ii)

Mark scheme

- they have the same number of electrons and therefore the same electronic configuration
- 1

Solution 1

(c)

Mark scheme

- M1 22 (M2)
- 16 and 18 (M3)
- 50 and 22 and to the left of the symbol (M4)
- Ti (M5)
- 2+
- 5

Solution 1

(d)

Mark scheme

- nucleon number
- 1

Solution 1

(e)

Mark scheme

- M1 mol Ar = $2.0 \div 40 = 0.05$ (mol) M2
- number of atoms = $0.05 \times 6.02 \times 10^{23} = 3.01 \times 10^{22}$
- 2
- 0620/41
- October/November 2025

Question 3

0620/22 J25 ■ Q3 ■ 1 mark

- 3 Which row gives the number of protons, electrons and neutrons in an atom of zinc?

	protons	electrons	neutrons
A	30	30	35
B	30	35	35
C	35	30	30
D	35	35	30

Solution 3

Answer: **A**

Why

- Zinc's proton number is 30, and a neutral atom has the same number of electrons.
- Its relative atomic mass is 65, so $\text{neutrons} = 65 - 30 = 35$.
- Protons and electrons must be equal in an atom, which rules out the other rows.

Question 4

0620/22 J25 ■ Q4 ■ 1 mark

4 Which particles have the electronic configuration 2,8,8?

- 1 an argon atom, Ar
- 2 an aluminium ion, Al^{3+}
- 3 a sodium ion, Na^{+}
- 4 a chloride ion, Cl^{-}

A 1 and 3

B 1 and 4

C 2 and 3

D 2 and 4

Solution 4

Answer: **B**

Why

- 2, 8, 8 means 18 electrons altogether.
- Argon has 18, and Cl^- has $17 + 1 = 18$.
- Al^{3+} has 10 and Na^+ has 10, so both are 2, 8 instead.

Question 2

0620/41 J25 ■ Q2 ■ 10 marks

- 2 Atoms are made of electrons, neutrons and protons.

(a) Complete Table 2.1.

Table 2.1

particle	relative charge	relative mass
electron		$\frac{1}{1840}$
neutron	0	
proton		

[2]

Question 2

(b) Atoms of the same element are known as isotopes.

${}_{19}^{39}\text{K}$ and ${}_{19}^{41}\text{K}$ are isotopes of potassium.

(i) Complete Table 2.2 to show the number of electrons, neutrons and protons in one atom or ion of these isotopes.

Table 2.2

isotope	electrons	neutrons	protons
${}_{19}^{39}\text{K}$			
${}_{19}^{41}\text{K}^{+}$			

[3]

(ii) Table 2.3 shows the relative masses and the percentage abundances of the two isotopes

Question 2

- vii) Table 2.3 shows the relative masses and the percentage abundances of the two isotopes in a sample of potassium.

Table 2.3

relative mass of isotope	percentage abundance of isotope
39	90
41	10

Calculate the relative atomic mass of this sample of potassium to **one** decimal place.

Question 2

..... relative atomic mass = [2]

- (iii) An isotope of aluminium has a nucleon number of 27.

Aluminium has a relative atomic mass of 27.

State what conclusion can be made from this information.

Question 2

(c) A calcium atom has the electronic configuration of 2,8,8,2.

Give the formula of one atom and one negative ion that has the same electronic configuration as Ca^{2+} .

Question 2

[2]

[Total: 10]

Solution 2

(a) Mark scheme

- charge 1
- mass(1)
- -1
- 1
- +1
- 1
- 1 mark for each correct column
- 2

Solution 2

- 0620/41
- May/June 2025

Solution 2

(b)(i) Mark scheme

- electron
- neutron
- proton
- 19
- 20
- 19
- 18
- 22

Solution 2

- 19
- 1 mark for each correct column
- 3

Solution 2

(b)(ii)

Mark scheme

- M1 $(41 \times 10) + (39 \times 90) = 3920$ 1 M2
- $(3920 \div 100) = 39.2(1)$
- 2

(b)(iii)

Mark scheme

- aluminium has only 1 isotope which has nucleon number 27/1

Solution 2

(c)

Mark scheme

- M1 Ar (1) (M2)
- P3– or S2– or Cl– (1)
- 2

Question 4

0620/22 M25 ■ Q4 ■ 1 mark

4 Sulfur atoms can form the negative ion S^{2-} .

Three other atoms or ions are listed.

- argon, Ar
- calcium, Ca
- oxide, O^{2-}

How many of these atoms or ions have the same electronic configuration as S^{2-} ?

A 0

B 1

C 2

D 3

Solution 4

Answer: **B**

Why

- S^{2-} has $16 + 2 = 18$ electrons, that is 2, 8, 8.
- Argon also has 18 electrons, so it matches.
- A calcium *atom* has 20 and O^{2-} has 10, so only one of the three matches.