



O-Level Chemistry (5070)

TOPICAL PAST PAPER

ATOMIC STRUCTURE

Theory: Structured Questions

2026 EDITION

Q1

5070/21/M/J/21/Q8(a)

Atomic Structure

Silver is a transition element with proton number 47.

(a) Use the Periodic Table to state the number of occupied electron shells in an atom of silver.

..... [1]

Q2

5070/22/M/J/21/Q8(a)

Atomic Structure

Lead is a metal with proton number 82.

(a) (i) Use the Periodic Table to state the number of occupied electron shells in an atom of lead.

..... [1]

(ii) Use the Periodic Table to state the number of electrons in the outer shell of an atom of lead.

..... [1]

Q3

5070/21/M/J/22/Q2(a)

Atomic Structure

(a) State the electronic configuration for phosphorus.

..... [1]

Q4

5070/22/M/J/22/Q2(a)

Atomic Structure

(a) State the electronic configuration for sulfur.

.....

[1]

Q5

5070/21/O/N/21/Q7(b)

Atomic Structure

(b) An ion of silver has the symbol



Deduce the number of protons, neutrons and electrons in this ion.

number of protons

number of neutrons

number of electrons[3]

Q6

5070/22/O/N/21/Q7(b)

Atomic Structure

(b) An ion of sodium has the symbol



Deduce the number of protons, neutrons and electrons in this ion.

number of protons

number of neutrons

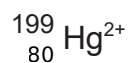
number of electrons[3]

Q7

5070/21/O/N/22/Q8(c)

Atomic Structure

(c) The full symbol of an ion of mercury is shown.



Deduce the number of electrons and neutrons in this ion.

number of electrons

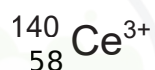
number of neutrons[2]

Q8

5070/22/O/N/22/Q8(c)

Atomic Structure

(c) The full symbol of an ion of cerium is shown.



Deduce the number of electrons and neutrons in this ion.

number of electrons

number of neutrons[2]

- (b) Complete the diagram in Fig. 2.1 to show the electronic configuration of a potassium ion.

Include the charge on the ion.

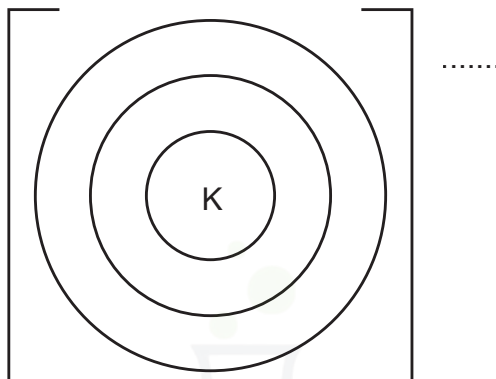


Fig. 2.1

[2]

- (d) Deduce the number of protons and neutrons in the copper atom shown.



number of protons

number of neutrons

[2]

Q10

5070/22/O/N/23/Q2(b),(d)

Atomic Structure

- (b) Deduce the number of protons and neutrons in the chromium atom shown.



number of protons

number of neutrons

[2]

- (d) Complete the diagram in Fig. 2.1 to show the electronic configuration of a sodium ion. Include the charge on the ion.

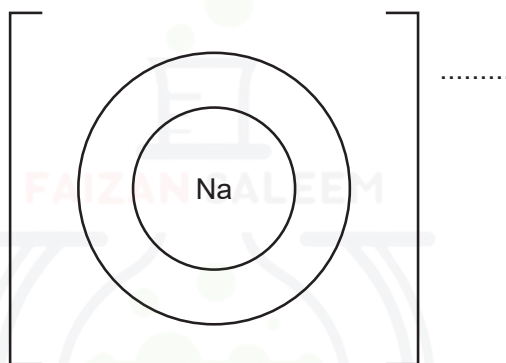


Fig. 2.1

[2]

Q11

5070/21/M/J/24/Q7(d)

Atomic Structure

- (d) The symbol of an iodide ion is shown.



Complete Table 7.1 about this iodide ion.

Table 7.1

particle	number of particles
electrons	
neutrons	
protons	

[3]

(d) The symbol of a sulfide ion is shown.



Complete Table 7.1 about this sulfide ion.

Table 7.1

particle	number of particles
electrons	
neutrons	
protons	

[3]

Q13

5070/21/M/J/21/Q2(c),(d)

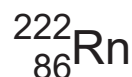
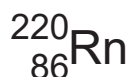
Atomic Structure

(c) Radon is very unreactive.

Use the electronic structure of radon to explain why.

.....
..... [1]

(d) Two isotopes of radon are shown.



(i) Give one similarity in the atomic structure of these two isotopes.

..... [1]

(ii) Give one difference in the atomic structure of these two isotopes.

..... [1]

Q14

5070/22/M/J/21/Q2(c)

Atomic Structure

(c) Two isotopes of polonium are shown.



(i) Explain why both isotopes have the same chemical properties.

..... [1]

(ii) Give one difference in the atomic structure of these two isotopes.

..... [1]

Q15

5070/21/M/J/22/Q4(a)-(d)

Atomic Structure

The table shows information about some particles.

particle	proton number	nucleon number
${}^{35}_{17}\text{Cl}$	17	35
${}^{35}_{17}\text{Cl}^{-}$	17	35
${}^{39}_{19}\text{K}$	19	39
${}^{39}_{19}\text{K}^{+}$	19	39

- (a) State the number of neutrons in ${}^{35}_{17}\text{Cl}$.

.....

[1]

- (b) State the number of electrons in ${}^{35}_{17}\text{Cl}^{-}$.

.....

[1]

- (c) ${}^{39}_{19}\text{K}$ is the full symbol for one isotope of potassium.

Suggest the full symbol for one **other** isotope of potassium.

.....

[1]

Q16

5070/22/M/J/22/Q4(a)-(d)

Atomic Structure

The table shows information about some particles.

particle	number of		
	protons	neutrons	electrons
${}^{79}_{35}\text{Br}$	35	44	35
${}^{79}_{35}\text{Br}^{-}$	35	44	
${}^{40}_{20}\text{Ca}$	20	20	20
${}^{40}_{20}\text{Ca}^{2+}$	20	20	18

- (a) State the nucleon number for ${}^{79}_{35}\text{Br}$.

.....

[1]

- (b) State the number of electrons in ${}^{79}_{35}\text{Br}^{-}$.

.....

[1]

- (c) ${}^{40}_{20}\text{Ca}$ is the full symbol for one isotope of calcium.

Write the full symbol for one **other** isotope of calcium.

.....

[1]

Q17

5070/21/M/J/23/Q4(a),(b)

Atomic Structure

This question is about compounds that contain phosphorus.

(a) The formula for a phosphide ion can be written as ${}_{15}^{31}\text{P}^{3-}$.

Complete Table 4.1 to show the number of particles in this phosphide ion.

Table 4.1

particle	number of particles
electron	
neutron	
proton	

[3]

Q18

5070/22/M/J/23/Q4(a),(b)

Atomic Structure

This question is about compounds that contain magnesium and nitrogen.

(a) The formula for a nitride ion can be written as ${}^{15}_{7}\text{N}^{3-}$.

Complete Table 4.1 to show the number of particles in this nitride ion.

Table 4.1

particle	number of particles
electron	
neutron	
proton	

[3]

Q19

5070/21/O/N/24/Q1

Atomic Structure

(b) Deduce the number of protons and neutrons in the chromium atom shown.



number of protons

number of neutrons

[2]

(b) Deduce the number of protons and neutrons in the vanadium atom shown.



number of protons

number of neutrons

[2]



A sample of sulfur found on the planet Mars contains four isotopes.

(a) Describe one difference between the isotopes $^{32}_{16}\text{S}$ and $^{33}_{16}\text{S}$.

..... [1]

(b) Explain why all the isotopes of sulfur have the same chemical properties.

.....

..... [1]



[2]

A sample of titanium found on an asteroid contains four isotopes.

Table 2.1 shows the percentage abundances of these four isotopes.

Table 2.1

isotope	percentage abundance
${}^{46}_{22}\text{Ti}$	9
${}^{47}_{22}\text{Ti}$	7
${}^{48}_{22}\text{Ti}$	75
${}^{49}_{22}\text{Ti}$	9

(a) Describe one difference between the isotopes ${}^{46}_{22}\text{Ti}$ and ${}^{47}_{22}\text{Ti}$.

..... [1]

(b) Explain why all the isotopes of titanium have the same chemical properties.

.....
..... [1]

[2]

Q1

5070/21/M/J/21/Q8(a)

Atomic Structure

5 occupied electron shells. [1]

Q2

5070/22/M/J/21/Q8(a)

Atomic Structure

(i) 6 occupied electron shells. [1]

(ii) 4 electrons in the outer shell. [1]

Q3

5070/21/M/J/22/Q2(a)

Atomic Structure

Electronic configuration of phosphorus: 2, 8, 5. [1]

Q4

5070/22/M/J/22/Q2(a)

Atomic Structure

Electronic configuration of sulfur: 2, 8, 6. [1]

Q5

5070/21/O/N/21/Q7(b)

Atomic Structure

Protons: 47. [1]

Neutrons: 62. [1]

Electrons: 46. [1]

Q6

5070/22/O/N/21/Q7(b)

Atomic Structure

Protons: 11. [1]

Neutrons: 12. [1]

Electrons: 10. [1]

Q7

5070/21/O/N/22/Q8(c)

Atomic Structure

Electrons: 78. [1]

Neutrons: 119. [1]

Q8

5070/22/O/N/22/Q8(c)

Atomic Structure

Electrons: 55. [1]

Neutrons: 82. [1]

Q9

5070/21/O/N/23/Q2(b),(d)

Atomic Structure

(b) Electronic configuration: 2, 8, 8; charge: +1. [2]

(d) Protons: 29; neutrons: 36. [2]

Q10

5070/22/O/N/23/Q2(b),(d)

Atomic Structure

(b) Protons: 24; neutrons: 29. [2]

(d) Electronic configuration: 2, 8; charge: +1. [2]

Q11

5070/21/M/J/24/Q7(d)

Atomic Structure

Electrons: 54.

Neutrons: 73.

Protons: 53. [3]

Q12

5070/22/M/J/24/Q7(d)

Atomic Structure

Electrons: 18.

Neutrons: 17.

Protons: 16. [3]

Q13

5070/21/M/J/21/Q2(c),(d)

Atomic Structure

(c) Radon has 8 electrons in its outer shell. [1]

(d)(i) The isotopes have 86 protons, 86 electrons, or the same electronic structure. [1]

(d)(ii) Radon-222 has two more neutrons than radon-220: 136 compared with 134. [1]

Q14

5070/22/M/J/21/Q2(c)

Atomic Structure

- (i) Both isotopes have the same electronic structure / electronic configuration. [1]
- (ii) Polonium-210 has one more neutron than polonium-209: 126 compared with 125. [1]

Q15

5070/21/M/J/22/Q4(a)-(d)

Atomic Structure

- (a) 18 neutrons. [1]
- (b) 18 electrons. [1]
- (c) One acceptable isotope is ${}^{40}_{19}\text{K}$. [1]

Q16

5070/22/M/J/22/Q4(a)-(d)

Atomic Structure

- (a) Nucleon number = 79. [1]
- (b) 36 electrons. [1]
- (c) One acceptable isotope is ${}^{41}_{20}\text{Ca}$. [1]
- (d) A calcium atom loses two electrons. [1]

Q17

5070/21/M/J/23/Q4(a),(b)

Atomic Structure

- (a) Electrons: 18; neutrons: 16; protons: 15. [3]
- (b) P^{3-} has a full outer shell of electrons. [1]

Q18

5070/22/M/J/23/Q4(a),(b)

Atomic Structure

- (a) Electrons: 10; neutrons: 8; protons: 7. [3]

Q19

5070/21/O/N/24/Q1

Atomic Structure

- (b) Protons: 24;
neutrons: 29. [2]

Q20

5070/22/O/N/24/Q1

Atomic Structure

- (a)(i) B. [1]
- (a)(ii) E. [1]
- (a)(iii) D. [1]
- (a)(iv) E. [1]
- (a)(v) C. [1]
- (b) Protons: 23; neutrons: 28. [2]

Q21

5070/21/O/N/25/Q2

Atomic Structure

- (a) The isotopes have different numbers of neutrons / different nucleon numbers. [1]
- (b) They have the same electronic configuration. [1]