02 Atomic Structure

Set A Concept Practice

Name	Time 45 minutes	Total 34 marks	Score ____ / 34

A From the lesson

17 MARKS

1 Which pair are isotopes?

A $^{12}_{6}C$ and $^{14}_{7}N$

B $^{12}_{6}C$ and $^{14}_{6}C$

C $^{23}_{11}Na$ and $^{23}_{11}Na^{+}$

D $^{16}_{8}O$ and $^{16}_{8}O^{2-}$

/1

Answer ☐ [1]

Source: Learners' Alley, Atomic Structure slides

2 How many neutrons are in $^{65}_{30}Zn^{2+}$?

A 28 **B** 30 **C** 35 **D** 37

/1

Answer ☐ [1]

Source: Learners' Alley, Atomic Structure slides

3 Which beam is deflected most in the same electric field?

A neutrons **B** protons **C** electrons **D** alpha particles

/1

Answer ☐ [1]

Source: Learners' Alley, Atomic Structure slides

4 What is the electronic configuration of Cu^{2+}?

A [Ar] $3d^9$

B [Ar] $3d^8\ 4s^1$

C [Ar] $3d^7\ 4s^2$

D [Ar] $3d^{10}$

/1

Answer ☐ [1]

Learners' Alley, Atomic Structure slides

5 Which element has a first ionisation energy lower than that of the element before it in the period?

A Mg **B** Al **C** Si **D** P

/1

Answer ☐ [1]

Learners' Alley, Atomic Structure slides

6 Complete the table. The first row is done for you.

species	protons	neutrons	electrons
^{23}Na	11	12	11
$^{23}Na^{+}$			
$^{32}S^{2-}$			
$^{65}Zn^{2+}$			

/3

[3]

Learners' Alley, Atomic Structure slides

7 Why do isotopes of an element react in the same way but differ in density?

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.....

/2

[2]

Learners' Alley, Atomic Structure slides

8 A beam of $^{1}H^{+}$ ions is deflected through +4°. What is the deflection of $^{2}H^{+}$ ions under the same conditions? Explain.

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.....

/1

[1]

Learners' Alley, Atomic Structure slides

9 Write the full electronic configurations of these atoms.

(a) K (19 electrons)

.....

[1]

(b) Mn (25 electrons)

.....

[1]

(c) Br (35 electrons)

.....

/3

[1]

Learners' Alley, Atomic Structure slides

10 The first seven ionisation energies of element J, in kJ mol^{-1}, are 1020, 1950, 2730, 4580, 6020, 12 300 and 15 400. Which group is J in? Explain.

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.....

/1

[1]

Learners' Alley, Atomic Structure slides

11 Explain why the second ionisation energy of sodium is much greater than its first.

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..... **[2]**

/2

Learners' Alley, Atomic Structure slides

B Practice

17 MARKS

12 Which statement about electrons, neutrons and protons is correct?

A The relative charge of a proton is equal but opposite in sign to the relative charge of an electron.

B The relative charge of a proton is the same as the relative charge of a neutron.

C The relative mass of an electron is about 2000 times the relative mass of a neutron.

D The relative masses of protons and electrons are the same.

Answer ☐ **[1]**

/1

2025 TKGS O Prelim P1 Q6

13 A particle, with a +4 charge, contains 48 particles in its nucleus and 18 electrons. What are the numbers of neutrons and protons found in its nucleus? Each option gives the neutrons, then the protons.

A 26 neutrons, 22 protons

B 28 neutrons, 20 protons

C 30 neutrons, 18 protons

D 34 neutrons, 14 protons

Answer ☐ **[1]**

/1

Source: 2024 Jurongville O Prelim P1 Q9

14 The nucleus of M^{3+} contains a total of 27 particles. 13 of the particles have a charge. Which statement about the ion is correct?

A It contains 13 neutrons and 10 electrons.

B It contains 13 protons and 10 electrons.

C It contains 13 protons and 13 electrons.

D It contains 14 neutrons and 13 electrons.

Answer ☐ **[1]**

/1

Source: 2024 USS O Prelim P1 Q5

15 The atomic number of cerium, Ce, is 58. A Ce^{4+} ion has 140 nucleons. How many neutrons and electrons are there in one Ce^{4+} ion? Each option gives the neutrons, then the electrons.

A 82 neutrons, 54 electrons

B 82 neutrons, 62 electrons

C 140 neutrons, 54 electrons

D 140 neutrons, 62 electrons

Answer ☐ **[1]**

/1

2025 FHSS O Prelim P1 Q6

16 Magnesium exists in three stable isotopes, Mg-24, Mg-25 and Mg-26. Which statements are correct about the properties of the isotopes?

1 The isotopes have the same number of electrons in their outermost shells.
2 The isotopes have the same physical properties.
3 The isotopes react with hydrochloric acid in the same manner.

A 1 and 2 only
B 1 and 3 only
C 2 and 3 only
D 1, 2 and 3

/1

Answer ☐ [1]

Source: 2024 Whitley O Prelim P1 Q6

17 Which statement about isotopes is correct?

A They have different numbers of electrons and react differently in chemical reactions.
B They have the same number of neutrons and exhibit identical chemical and physical properties.
C They have different mass numbers but undergo the same chemical reactions.
D They have different proton numbers and belong to different elements.

/1

Answer ☐ [1]

Source: 2025 TKGS O Prelim P1 Q7

18 Chlorine-35 and chlorine-37 are two isotopes of chlorine. Which statements are correct?

1 They have the same atomic number.
2 They have the same mass number.
3 They have the same physical properties.
4 They have the same chemical properties.

A 1 and 2 only
B 1 and 4 only
C 2 and 3 only
D 2 and 4 only

/1

Answer ☐ [1]

2025 JYSS O Prelim P1 Q7

19 The numbers of electrons, protons and neutrons in four different particles are shown.

particle	electrons	protons	neutrons
W	19	19	20
X	18	19	20
Y	20	20	20
Z	19	19	22

Which particles are isotopes of the same element?

A W and X
B W and Z
C X and Z
D W, X and Z

/1

Answer ☐ [1]

2024 Compassvale O Prelim P1 Q7

20 An element, Z, has p protons and n neutrons in its nucleus. Which row gives a possible correct number of protons, neutrons and electrons in a negative ion of an isotope of Z? Each option gives the protons, neutrons and electrons in that order.

A $p, n + 1, p + 1$
B $p, n + 1, p - 1$

C $p + 1, n, p + 1$ **D** $p + 1, n, p - 1$

/1

Answer [1]

2025 MSHS O Prelim P1 Q3

21 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 O Prelim P1 Q4

22 A beam of protons was passed through an electrostatic field between two charged plates. The electrostatic field deflected the beam of protons towards the negatively charged plate. The lower the relative mass of the particle, the larger the deflection. The experiment was repeated using a beam of electrons in place of the beam of protons. Which row correctly shows the extent and the direction of the deflection of the beam of electrons?

A deflected less than the beam of protons, in the opposite direction

B deflected less than the beam of protons, in the same direction

C deflected more than the beam of protons, in the opposite direction

D deflected more than the beam of protons, in the same direction

/1

Answer [1]

Source: 2024 BTYSS FYE O EOY P1 Q6

23 An element J has a nucleon number of 45. The ion, J^{3+}, contains 18 electrons. How many neutrons are there in an atom of J?

A 18 **B** 21 **C** 24 **D** 27

/1

Answer [1]

Source: 2024 Dunman O Prelim P1 Q6

24 In which species are the numbers of protons, neutrons and electrons all different?

A $^{27}_{13}Al$ **B** $^{35}_{17}Cl^-$ **C** $^{32}_{16}S^{2-}$ **D** $^{39}_{19}K^+$

/1

Answer [1]

Source: 2024 CHS O Prelim P1 Q7

25 An ion X^{2-} has m nucleons and n electrons. What does the nucleus of an atom of X contain? Each option gives the number of protons, then the number of neutrons.

A $n - 2$ protons, $m - n$ neutrons **B** $n - 2$ protons, $m - (n - 2)$ neutrons

C $n + 2$ protons, $m - (n - 2)$ neutrons **D** $n + 2$ protons, $m - (n + 2)$ neutrons

/1

Answer [1]

Source: 2024 SNGS O Prelim P1 Q1

26 Carbon has three naturally occurring isotopes, carbon-12, carbon-13 and carbon-14. Which statement about carbon-14 is incorrect?

A It is found in carbon dioxide in the atmosphere.

B It reacts with limited oxygen to form carbon monoxide.

C It has a different electronic configuration from the other isotopes.

D It has the greatest number of neutrons compared to the other isotopes.

/1

Answer [1]

Source: 2024 CCHM O Prelim P1 Q9

27 Which species are from the same group of the Periodic Table?

1 an atom with the electronic configuration of 2.3
2 an atom with the electronic configuration of 2.8.3
3 an ion with a 3– charge and an electronic configuration of 2.8.8

A 1 and 3 only **B** 1 and 2 only **C** 2 and 3 only **D** 1, 2 and 3

/1

Answer [1]

Source: 2025 TKGS O Prelim P1 Q24

28 The element with proton number 12 has similar chemical properties to the element with which proton number?

A 2 **B** 11 **C** 20 **D** 24

/1

Answer [1]

2024 BMSS O Prelim P1 Q26

10 The Periodic Table of Elements

Group																	
1	2											13	14	15	16	17	18
							1 H hydrogen 1.0										2 He helium 4.0
3 Li lithium 6.9	4 Be beryllium 9.0											5 B boron 10.8	6 C carbon 12.0	7 N nitrogen 14.0	8 O oxygen 16.0	9 F fluorine 19.0	10 Ne neon 20.2
11 Na sodium 23.0	12 Mg magnesium 24.3	3	4	5	6	7	8	9	10	11	12	13 Al aluminium 27.0	14 Si silicon 28.1	15 P phosphorus 31.0	16 S sulfur 32.1	17 Cl chlorine 35.5	18 Ar argon 39.9
19 K potassium 39.1	20 Ca calcium 40.1	21 Sc scandium 45.0	22 Ti titanium 47.9	23 V vanadium 50.9	24 Cr chromium 52.0	25 Mn manganese 54.9	26 Fe iron 55.8	27 Co cobalt 58.9	28 Ni nickel 58.7	29 Cu copper 63.5	30 Zn zinc 65.4	31 Ga gallium 69.7	32 Ge germanium 72.6	33 As arsenic 74.9	34 Se selenium 79.0	35 Br bromine 79.9	36 Kr krypton 83.8
37 Rb rubidium 85.5	38 Sr strontium 87.6	39 Y yttrium 88.9	40 Zr zirconium 91.2	41 Nb niobium 92.9	42 Mo molybdenum 95.9	43 Tc technetium –	44 Ru ruthenium 101.1	45 Rh rhodium 102.9	46 Pd palladium 106.4	47 Ag silver 107.9	48 Cd cadmium 112.4	49 In indium 114.8	50 Sn tin 118.7	51 Sb antimony 121.8	52 Te tellurium 127.6	53 I iodine 126.9	54 Xe xenon 131.3
55 Cs caesium 132.9	56 Ba barium 137.3	57–71 lanthanoids	72 Hf hafnium 178.5	73 Ta tantalum 180.9	74 W tungsten 183.8	75 Re rhenium 186.2	76 Os osmium 190.2	77 Ir iridium 192.2	78 Pt platinum 195.1	79 Au gold 197.0	80 Hg mercury 200.6	81 Tl thallium 204.4	82 Pb lead 207.2	83 Bi bismuth 209.0	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89–103 actinoids	104 Rf rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –	113 Nh nihonium –	114 Fl flerovium –	115 Mc moscovium –	116 Lv livermorium –	117 Ts tennessine –	118 Og oganesson –

Key

atomic number
atomic symbol
name
relative atomic mass

lanthanoids	57 La lanthanum 138.9	58 Ce cerium 140.1	59 Pr praseodymium 140.9	60 Nd neodymium 144.2	61 Pm promethium –	62 Sm samarium 150.4	63 Eu europium 152.0	64 Gd gadolinium 157.3	65 Tb terbium 158.9	66 Dy dysprosium 162.5	67 Ho holmium 164.9	68 Er erbium 167.3	69 Tm thulium 168.9	70 Yb ytterbium 173.1	71 Lu lutetium 175.0
actinoids	89 Ac actinium –	90 Th thorium 232.0	91 Pa protactinium 231.0	92 U uranium 238.0	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –