OCR GCSE GATEWAY CHEMISTRY A · J248

CHEMISTRY



MARK SCHEME

C1.2 ATOMIC STRUCTURE

SCORE	PERCENTAGE
/123	%

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<table>
<tr><th>Particle</th><th>Atomic number</th><th>Mass number</th><th>Number of protons</th><th>Number of neutrons</th><th>Number of electrons</th><th>Electronic structure</th></tr>
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</td><td>4</td><td>one mark scored for each correct line</td></tr>
<tr><td></td><td>b</td><td></td><td>particle A – one electron in outer shell or energy level (1)
particle D – has more protons than electrons (1)</td><td>2</td><td></td></tr>
<tr><td></td><td>c</td><td></td><td>group 7 (1) as 7 electrons in outer shell (1)
period 3 (1) as 3 shells occupied (1)</td><td>4</td><td></td></tr>
<tr><td></td><td>d</td><td></td><td>
<table>
<tr><th></th><th>Charge</th><th>Mass in atomic mass units</th></tr>
<tr><td>proton</td><td>positive /+</td><td>1</td></tr>
<tr><td>neutron</td><td>neutral / no charge</td><td>1</td></tr>
<tr><td>electron</td><td>negative</td><td>0.0005</td></tr>
</table>
</td><td>2</td><td>one mark scored for each correct column (2)

ALLOW
1/1760
or 1/1836
or 1/2000</td></tr>
<tr><td></td><td>e</td><td></td><td>idea of the nuclear atom (1)</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>13</td><td></td></tr>
<tr><td>3</td><td></td><td></td><td>B</td><td>1</td><td></td></tr>
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<tr><td></td><td></td><td></td><td>Total</td><td>8</td><td></td></tr>
</table>

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Question			Answer/Indicative content	Marks	Guidance
5	a		**graphite** – has a layered structure (1) electrons can move / electrons between layers or delocalised (1) **diamond** – no free electrons or ions (1)	3	
	b		it can bond to itself (and make chains and rings) (1)	1	
			Total	**4**	
6	a	i	17 (1)	1	
		ii	7 (1)	1	
		iii	3 (1)	1	**Examiner's Comments** Many candidates correctly answered all three parts of this question, although examiners saw a wide range of incorrect responses.
	b		atoms with the same atomic number / same number of protons / same proton number (1) but different mass numbers / different numbers of neutrons (1)	2	**allow** an element with the same atomic number (1) but different mass number (1) **allow** atoms with same number of protons but different mass for (2) **Examiner's Comments** The meaning of isotopes was not well understood. Examiners saw a wide range of incorrect ideas.
			Total	**5**	
7			atom **Y** – no of protons = **3 and** no of neutrons = **4** (1) atom **Z** – mass number = **12** (1) atom **Z** – electronic structure is **2.4** (1)	3	**Examiner's Comments** This question was about atomic structure. Many candidates could interpret the table to get at least two entries correct. The most likely incorrect answers were to give the mass number of particle **Z** to be 6 and / or to give the incorrect electronic structure. Some able candidates did not attempt this question.
			Total	**3**	

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Question			Answer/Indicative content	Marks	Guidance
8			isotopes (1) same atomic number but different mass numbers / same number of protons but different numbers of neutrons (1)	2	**allow** an element with the same atomic number but different mass number / same type of atom with different numbers of neutrons **allow** same element with different numbers of neutrons is sufficient **ignore** references to electrons **ignore** halogens **ignore** wrong number of neutrons quoted **Examiner's Comments** This question was about atomic structure. The term isotope was known by many candidates although a few confused this with allotrope. Another misconception was to call the two types of atom halogens. Candidates often gave the correct explanation even when they did not give the correct term. The best answers referred to atoms with the same atomic number but different mass number (or number of neutrons) however in the context of the question less precise explanations where allowed in the mark scheme.
			Total	2	

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Question			Answer/Indicative content	Marks	Guidance
9			**Level 3** **Candidate applies knowledge to predict more than one correct observation** **AND** **names both of the products** **AND** **predicts a correct reaction time for rubidium.** Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **Level 2** **Candidate applies knowledge to predict more than one correct observation** **AND** **EITHER names one of the products** **OR** **predicts a correct reaction time for rubidium.** Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **Level 1** **Candidate applies knowledge to predict one observation** **OR** **the name of one product** **OR** **predicts a correct reaction time for rubidium.** Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **Level 0** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grades up to C.** **Indicative scientific points may include:** **Observations** • melts • moves across the surface (of the water) • catches fire or explodes or sparks • gas given off • alkaline solution made **Names of Products** • hydrogen • rubidium hydroxide **Reaction Time** • any time less than 7 seconds **Use the L1, L2, L3 annotations in Scoris; do not use ticks.** **Examiner's Comments** Most candidates could predict at least two observations, with many offering far more. Better candidates talked about how the reactivity of the elements increases as Group 1 is descended and hence predicted reaction times of less than 7 seconds. Far fewer candidates named the products even with the hint that a gas was given off that burns with a 'pop'. It was rare to see rubidium hydroxide mentioned.
			Total	**6**	

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Question			Answer/Indicative content	Marks	Guidance
10	a		12 (1)	1	Examiner's Comments Most candidates could use the periodic table correctly to identify 12 as the atomic number of magnesium. A few quoted 24 and failed to score.
	b		number of protons + number of neutrons (in an atom) (1)	1	**allow** number of particles in the nucleus (1) Examiner's Comments Less than a fifth of candidates understood the term mass number. Most thought it was the relative atomic mass of nitrogen. A number realised it was the number of particles but then lost the mark by stating, for example, 'the number of protons and electrons in the atom'.
	c		idea of just one symbol (1)	1	**allow** it is on the periodic table (1) **allow** it can't be split into two different atoms (1) **allow** idea that it only has one capital letter (1) **allow** idea that it is not bonded with another atom (1) **allow** formula doesn't contain other elements (1) Examiner's Comments Common correct answers were that magnesium is on the periodic table or that the symbol only has one capital letter.
	d		**any two from:** Dobereiner (1) Newlands (1) Mendeleev (1)	2	Examiner's Comments The development of the periodic table continues to be an area that candidates find challenging. Very few candidates scored on this question. Common incorrect answers included Einstein, Darwin and Newton.
			Total	**5**	

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<tr><td>11</td><td>a</td><td></td><td>
<table>
<tr><th></th><th>Chlorine atom</th><th>Oxide ion</th></tr>
<tr><td>Number of protons</td><td>17</td><td>8</td></tr>
<tr><td>Number of neutrons</td><td>20</td><td>8</td></tr>
<tr><td>Number of electrons</td><td>17</td><td>10</td></tr>
</table>

chlorine – number of protons and number of neutrons correct (1)

oxide ion – number of neutrons correct (1)

- number of electrons correct (1)</td><td>3</td><td><u>?Examiner's Comments</u>??

Only a small proportion of the candidates were able to get all four entries in the table correct. Candidates found filling in the information about the chlorine atom easier than that for the oxide ion. Many candidates did not take account of the charge on the oxide ion when calculating the number of electrons.</td></tr>
<tr><td></td><td>b</td><td></td><td>J J Thomson - discovered the electron (1)

Bohr suggested - that electrons occupy orbits / electrons in shells / electrons in energy levels (1)</td><td>2</td><td>ignore reference to plum pudding model

allow discovered that atoms have electrons

not electrons were found in the nucleus / discovered that electrons orbit the nucleus / reference to ions

not discovered neutrons or protons

negative particles in shells is not sufficient

allow reference to orbitals

ignore reference to other aspects of atomic structure e.g. protons and neutrons

<u>?Examiner's Comments</u>??

Candidates found this recall question quite challenging. Candidates often referred to the ‘plum pudding’ model when describing J.J. Thomson’s contribution. Most candidates failed to appreciate that J.J. Thomson discovered the electron. More candidates were able to describe Bohr’s contributions and referred to electron shells or electron orbits. Some candidates referred to the discovery of the Periodic Table or to the ‘gold leaf’ experiment. A significant proportion of candidates left this question blank.</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>5</td><td></td></tr>
</table>

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Question			Answer/Indicative content	Marks	Guidance
12		i	**W** (1)	1	**allow** sodium / Na Examiner's Comments Many candidates recognised that **W** forms a positive ion, with **Z** and **Y** being the most common incorrect answers. The noble gas structure of **Z** was recognised by many candidates.
		ii	**Z** (1)	1	**allow** argon / Ar ?Examiner's Comments?? **W** and **Y** were recognised as atoms that combine by forming an ionic bond
		iii	**W** and **Y** (1)	1	both required but order is unimportant **allow** sodium or Na **and** chlorine or C*l* Examiner's Comments ?? Some candidates actually identified the elements by name although this was not needed in the mark scheme.
			Total	3	

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Question			Answer/Indicative content	Marks	Guidance
13	a		Level 3 Deduce the number of protons, neutrons and electrons and the electronic structure for the atom of aluminium AND Identifies both the group and period for aluminium Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) Level 2 Deduce the number of protons, neutrons and electrons in the aluminium atom or the electronic structure and identifies the group or the period of aluminium OR Deduce the number of protons and neutrons in the aluminium atom and the electronic structure of aluminium Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) Level 1 Deduce the number of protons and neutrons OR Deduce the electronic structure for aluminium OR Identifies the group or the period of aluminium Quality of written communication impedes communication of the science at this level. (1 – 2 marks) Level 0 Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	This question is targeted at grades up to A*. Indicative scientific points may include: • number of protons is 13 / bottom number is number of protons • number of neutrons is 14 / difference between mass number and atomic number • number of electrons is 13 / same as number of protons • electronic structure is 2.8.3 – this also shows 13 electrons • Al is in the 3rd period / the number of (occupied) shell electrons is the period number • Al is in Group 3 / the number of electrons in the outer shell is the group number Allow row for period and column for group Use the L1, L2, L3 annotations in Scoris; do not use ticks. Examiner's Comments This question assessed the quality of written communication in the context of the interpretation of an atomic symbol. Candidates often gave very good answers where they made deductions about the atomic structure of aluminium that included an explanation for the deduction. Candidates were able to deduce the number of subatomic particles in the aluminium atom and also the electronic structure. Many used the electronic structure to state the group number and the period number for aluminium. One common misconception was the mass number represented the relative atomic mass. Some candidates referred to rows and columns in the periodic table rather than periods and groups. If candidates

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<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th>Guidance</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>gave a group number it was invariably correct but a small proportion of the candidates gave the period number as 2 rather than 3.</td></tr>
<tr><td></td><td>b</td><td></td><td>Any two from:

Fired alpha particles at gold foil (1)

Geiger and Marsden's experiment gave unexpected results / some alpha particles rebounded (1)

led to theory of nuclear atom / idea of atoms having a nucleus (1)</td><td>2</td><td>Allow wrong particle rebounded if mentioned already at MP1
Allow reflected rather than rebounded

Ignore reference to electrons, protons and shells

Atoms have a dense centre is not sufficient

Examiner's Comments

Only an extremely small proportion of the candidates could describe the correct experiment or appreciate that the results of the experiments were unexpected. Many candidates were awarded a mark that the experiment was connected with the discovery of the nuclear atom. A significant proportion of the candidates did not attempt this question.</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>8</td><td></td></tr>
<tr><td>14</td><td></td><td></td><td>relative mass of neutron (1)

relative charge of electron (1)</td><td>2</td><td><table><tr><th>Particle</th><th>Relative charge</th><th>Relative mass</th></tr><tr><td>proton</td><td>+1</td><td>1</td></tr><tr><td>neutron</td><td>0</td><td>1</td></tr><tr><td>electron</td><td>-1</td><td>0.0005</td></tr></table>
Examiner's Comments

The relative charge on an electron was well known but the relative mass of a neutron was less well known.</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>2</td><td></td></tr>
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Question			Answer/Indicative content	Marks	Guidance
15			sodium (atoms) lose electrons (1) chlorine (atoms) gain electrons (1)	2	**allow** sodium ions have more protons than electrons **not** sodium ions lose electrons **allow** chloride ions have more electrons than protons **not** chloride ions gain electrons **Examiner's Comments** The best answers described how an electron is transferred from a sodium atom to a chlorine atom. Other good answers appreciated that a sodium ion had one less electron than protons and a chloride ion had one more electron than protons. A significant proportion of the candidates referred to the sodium ion losing electrons and/or the chloride ion gaining electrons, these answers were not given credit in the mark scheme.
			Total	2	

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<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>16</td><td>a</td><td></td><td>$^{32}_{15}$P(1)

18 electrons (1)</td><td>2</td><td>
<table>
<tr><th>atom or ion</th><th colspan="3">number of</th></tr>
<tr><th></th><th>electrons</th><th>neutrons</th><th>protons</th></tr>
<tr><td>$^{1}_{1}$H</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>$^{2}_{1}$H</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>$^{31}_{15}$P</td><td>15</td><td>16</td><td>15</td></tr>
<tr><td>$^{32}_{15}$P</td><td>15</td><td>17</td><td>15</td></tr>
<tr><td>$^{32}_{16}S^{2-}$</td><td>18</td><td>16</td><td>16</td></tr>
</table>
allow ^{32}P

not $_{32}$P

Examiner's Comments

A small but significant proportion of the candidates left this question blank. Candidates often gave the element as sulfur rather than phosphorus and the number of electrons as 16 rather than 18.</td></tr>
<tr><td></td><td>b</td><td></td><td>same atomic number and different mass number (1)</td><td>1</td><td>allow same proton number or number of protons and different number of neutrons or atomic mass
allow same element but different mass number / same type of atom and different number of neutrons
ignore same number of electrons
not different relative atomic mass

Examiner's Comments

Many candidates could define the term isotopes and referred to atoms having the same atomic number but different number of neutrons.</td></tr>
</table>

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Question			Answer/Indicative content	Marks	Guidance
	c		any two from: so results can be replicated / so work does not need to be duplicated (1) so further evidence can be collected (1) idea of peer review / work can be checked (1) to provide information to other scientists or public or other organisations / AW (1) so he can get recognition for his work (1)	2	 allow work can be developed further (1) allow so work can be evaluated (1) allow idea that information can be used by other scientists (1) allow idea of to increase the sum of human knowledge / to educate people (1) allow so other scientists cannot take credit (1) Examiner's Comments Candidates often appreciated that scientists publish their results so that their work could be checked. Candidates rarely used the term peer review but often described this in words. Candidates who were awarded two marks often went on to describe the idea of developing the scientific work or collecting more evidence.
			Total	5	

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Question			Answer/Indicative content	Marks	Guidance
17	a		Level 3 Recall or deduce one piece of information about atomic number AND one about mass number AND deduces the number of protons, neutrons and electrons. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) Level 2 Recall or deduce one piece of information about atomic number AND one about mass number OR deduces the number of protons, neutrons and electrons. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) Level 1 Recall or deduce one piece of information about atomic number OR recall or deduce one piece of information about mass number OR deduce the number of protons or neutrons or electrons. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) Level 0 Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	This question is targeted at grades up to C. Indicative scientific points may include: • bottom number is atomic number or proton number • atomic number or proton number is 13 • atomic number or proton number is the number of protons in the nucleus • atomic number or proton number is the number of electrons • top number is mass number or atomic mass • mass number or atomic mass is 27 • mass number or atomic mass is the total number of protons and neutrons in the nucleus • number of protons is 13 • number of neutrons is 14 • number of electrons is 13 allow higher level answers at level 3 such as: • electronic structure is 2.8.3. • A*l* is in the 3rd period or row • A*l* is in Group 3 or column 3 • A*l* forms 3+ ions allow 2 or more higher level answers with no other points - 5 marks Use the L1, L2, L3 annotations in Scoris; do not use ticks. Examiner's Comments About a third of candidates scored level 3 (5 or 6 marks) on this question. They could identify the mass number and atomic number and work out the number of protons, neutrons and electrons. The best candidates could work out the electronic structure and state that aluminium was in group 3. Just over a third of candidates gained level 2 (3 or 4 marks). They either identified mass number and atomic number or stated the number of protons, neutrons and electrons.

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Question			Answer/Indicative content	Marks	Guidance
	b		(J.J. Thomson) discovered the electron (1) (Rutherford) suggested the nuclear atom (1)	2	**allow** references to discovery of electron and nuclear atom without assigning names (up to 2 marks) **allow** more detailed answers re J. J. Thomson or Rutherford for 2 marks Examiner's Comments Candidates found this question difficult. Where a mark was scored, it was usually for mentioning the discovery of electrons, although this was rarely attributed to J. J. Thomson. Many candidates confused the work of Rutherford and J. J. Thomson with Mendeleev's work on the development of the periodic table.
			Total	8	

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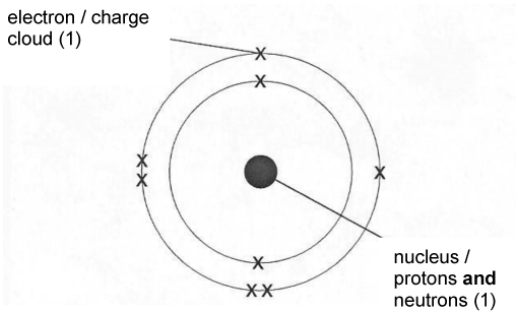
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Question			Answer/Indicative content	Marks	Guidance
18	a		**any two from:** so results can be replicated (1) so further evidence can be collected (1) idea of peer review (1) idea of gaining credit for (1)	2	**allow** so the theory can be tested **allow** so the theory can be developed **allow** idea that theory can be proved right or wrong if no other mark awarded award 1 mark for idea of telling others (scientists) what they have found out (1) **Examiner's Comments** Almost everyone got a mark here, but very few got both. All the possible answers displayed in the mark scheme appeared about equally.
	b		**any one from:** in Rutherford's theory the atom can be split / Rutherford's theory does not have solid atoms / Rutherford's theory has atoms of mostly space (1) in Dalton's theory atoms could not be split (1)	1	**allow** presence of nucleus or electrons in Rutherford's theory / smaller particles present **allow** Dalton was unaware that electrons / nucleus exist **Examiner's Comments** A majority were able to score here, but the use of language was difficult to follow in a lot of answers. The most common answer was that Rutherford stated that atoms could be split.
	c		negative (1)	1	**allow** minus / -1 **Examiner's Comments** A significant proportion of candidates continue to think that electrons are positive.
			Total	**4**	

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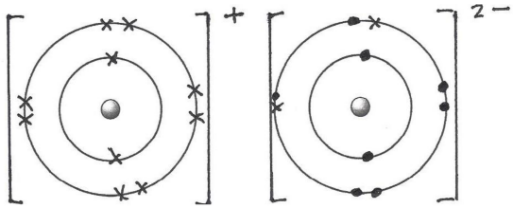
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Question			Answer/Indicative content	Marks	Guidance
19	a		17 (1)	1	**Examiner's Comments** Many correct answers. A few candidates repeated the electronic structure of the elements.
	b		12 (1)	1	**Examiner's Comments** Many correct answers. A few candidates repeated the electronic structure of the elements.
			Total	**2**	
20	a			2	**allow** phonetic spelling of nucleus
	b		carbon **and** tin (1) idea of same vertical arrangement (1)	2	**both required** **allow** same number of electrons in outer shell (1) **allow** they are both in Group 4 (1)
			Total	**4**	

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Question			Answer/Indicative content	Marks	Guidance
21	a		lithium atom loses 1 electron (1) to gain a full outer shell / stable outer shell / full outer orbit / stable outer orbit (1)	2	**Allow** lithium loses electrons **allow** it loses the outer shell electrons **not** reference to stable outer octet **allow** without a full outer shell it is unstable
	b		 Na^+ O^{2-} correct electronic structure of sodium ion (1) correct electronic structure of oxide ion (1) both charges correct (1)	3	sharing of electrons = 0 marks for this question use of dots and crosses not necessary i.e. can be all crosses or all dots no need to show $2Na^+$ inner shell must be shown and correct inner shell must be shown and correct **allow** diagram showing transfer of electrons providing electrons are not shown twice
			Total	5	

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<tr><th>Particle</th><th>Relative mass</th><th>Relative charge</th></tr>
<tr><td>electron</td><td>0.0005</td><td>–1</td></tr>
<tr><td>proton</td><td>1</td><td>+1 / positive</td></tr>
<tr><td>neutron</td><td>1</td><td>0 / neutral</td></tr>
</table>
four correct (2)

two or three correct (1)

one correct (0)</td><td>2</td><td>note the + sign must be present for the proton</td></tr>
<tr><td></td><td>b</td><td></td><td>idea that atoms have the same number, or amount, of electrons as protons / same number, or amount, of positive and negative charges (1)</td><td>1</td><td>allow the sum of the relative charges of the protons and electrons add up to neutral

ignore references to neutrons</td></tr>
<tr><td></td><td>c</td><td></td><td>C (1)</td><td>1</td><td>allow correct answer ticked, underlined or circled if answer line is blank
answer line takes precedence</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>4</td><td></td></tr>
<tr><td>23</td><td></td><td></td><td>B ✓</td><td>1(AO1.1)</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>1</td><td></td></tr>
</table>

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<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>24</td><td></td><td>i</td><td>
<table>
<tr><th>Isotope</th><th>Number of protons</th><th>Number of neutrons</th><th>Number of electrons</th></tr>
<tr><td>Chlorine-35</td><td>17</td><td>18</td><td>17</td></tr>
<tr><td>Chlorine-37</td><td>17</td><td>20</td><td>17</td></tr>
</table>
✓
✓</td><td>2(AO1.1)</td><td><u>Examiner's Comments</u>

Most candidates were able to correctly deduce the numbers of sub-atomic particles in these two isotopes of chlorine.</td></tr>
<tr><td></td><td></td><td>ii</td><td>$Cl_2 + 2e^- \rightarrow 2Cl^-$ ✓</td><td>1(AO2.1)</td><td>ALLOW $Cl_2 \rightarrow 2Cl^- - 2e^-$
ALLOW any correct multiple, including fractions
ALLOW = / ⇌ instead of →
DO NOT ALLOW and / & instead of '+'
balancing mark is dependent on the correct formulae but
<u>Examiner's Comments</u>

Lower ability candidates often gave the reverse equation, i.e. $2Cl^- \rightarrow Cl_2 + 2e^-$.

Other common errors included equations with the following incorrect species: Cl_2^-, Cl^+ or Cl_2^+.</td></tr>
<tr><td></td><td></td><td>iii</td><td>Ba^{2+} (aq) + SO_4^{2-} (aq) → $BaSO_4$ (s)

Equation ✓

State symbols ✓</td><td>2(AO2.1)</td><td>ALLOW any correct multiple, including fractions
ALLOW = / ⇌ instead of →
DO NOT ALLOW and / & instead of '+'

Mark for state symbols is dependent on correct species

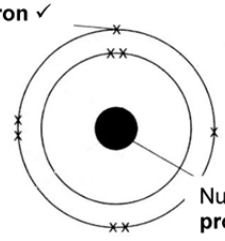
ALLOW a full balanced ionic equation
Ba^{2+} (aq) + $2Cl^-$ (aq) + $2Na^+$(aq) + SO_4^{2-} (aq) → $BaSO_4$(s) + $2Na^+$(aq) + $2Cl^-$(aq)
<u>Examiner's Comments</u>

Many candidates wrote a balanced <u>symbol</u> equation for this reaction rather than a balanced <u>ionic</u> equation. Another common error was to omit the state symbols.</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>5</td><td></td></tr>
<tr><td>25</td><td></td><td></td><td>D</td><td>1
(AO 1.1)</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>1</td><td></td></tr>
</table>

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Question			Answer/Indicative content	Marks	Guidance
26			A	1 (AO 2.1)	Examiner's Comments B and D were quite common incorrect responses.
			Total	1	
27	a	i	**electron** ✓  Nucleus containing **protons** and **neutrons** ✓ **(Need both for the mark)**	2 (AO1.1)	ALLOW either order Examiner's Comments A small number of candidates used biology terms including chromosomes and DNA or labelled the nucleus protons and electrons.
		ii	Has equal numbers of (positive) protons and (negative) electrons ✓	1 (AO2.1)	q asks for particles IGNORE protons cancel electrons Examiner's Comments Many referred to protons cancelling electrons with no reference to charges or numbers or stated that electrons are negative and protons positive with no further explanation or discussed neutrons and protons.
	b		Isotopes have same number of protons (and electrons) ✓ Isotopes have different numbers of neutrons ✓	2 (AO1.1)	ALLOW same proton number/same atomic number ALLOW different mass number/number of nucleons/atomic mass DO NOT ALLOW different RAM/M_r ALLOW 1 mark for same protons and different neutrons Examiner's Comments Some candidates reversed atomic number and mass number or referred to mass number as relative atomic mass. Atomic number was better known than mass number.
			Total	5	

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<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>28</td><td></td><td></td><td>C</td><td>1
(AO2.1)</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>1</td><td></td></tr>
<tr><td>29</td><td></td><td></td><td>B</td><td>1
(AO2.1)</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>1</td><td></td></tr>
<tr><td>30</td><td></td><td>i</td><td>Unreactive ✓

Full outer shell (of electrons) ✓</td><td>2
(AO2.1
1.1)</td><td>ALLOW doesn’t bond / doesn’t lose or gain electrons / doesn’t share electrons

ALLOW (argon has a) stable electronic structure / 8 electrons in outer shell</td></tr>
<tr><td></td><td></td><td>ii</td><td><table><tr><th></th><th>$^{20}_{10}Ne$</th><th>$^{22}_{10}Ne$</th></tr><tr><td>Proton</td><td>10</td><td>10</td><td>✓</td></tr><tr><td>Neutron</td><td>10</td><td>12</td><td>✓</td></tr><tr><td>Electron</td><td>10</td><td>10</td><td>✓</td></tr></table></td><td>3
(AO2.1)</td><td>1 mark for each row</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>0</td><td></td></tr>
<tr><td>31</td><td></td><td></td><td>C ✓</td><td>1
(AO1.1)</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>1</td><td></td></tr>
<tr><td>32</td><td></td><td></td><td>C ✓</td><td>1
(AO2.1)</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>1</td><td></td></tr>
<tr><td>33</td><td></td><td></td><td>C ✓</td><td>1
(AO1.1)</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>1</td><td></td></tr>
</table>

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<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>34</td><td></td><td>i</td><td><u>Unreactive</u> ✓

Full outer shell (of electrons) ✓</td><td>2
(AO2.1
1.1)</td><td>ALLOW doesn’t bond / doesn’t lose or gain electrons / doesn’t share electrons

ALLOW (argon has a) stable electronic structure / 8 electrons in outer shell</td></tr>
<tr><td></td><td></td><td>ii</td><td>
<table>
<tr><th></th><th>$^{20}_{10}Ne$</th><th>$^{22}_{10}Ne$</th><th></th></tr>
<tr><td>Proton</td><td>10</td><td>10</td><td>✓</td></tr>
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<tr><td>Electron</td><td>10</td><td>10</td><td>✓</td></tr>
</table>
</td><td>3
(AO2.1)</td><td>1 mark for each row</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>5</td><td></td></tr>
</table>

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