

Past-paper walk-through

Ionisation energy ■ 1.4

eXercise

Questions in this set

- 9701/11 N25 Q2 ■ 1 mark
- 9701/12 N25 Q2 ■ 1 mark
- 9701/12 N25 Q7 ■ 1 mark
- 9701/13 N25 Q2 ■ 1 mark

Question 2

9701/11 N25 ■ Q2 ■ 1 mark

- 2 The data in the table gives the 5th to the 10th ionisation energies of three elements from Period 3 of the Periodic Table.

element	ionisation energy / kJ mol^{-1}					
	5th	6th	7th	8th	9th	10th
X	6274	21 269	25 398	29 855	35 868	40 960
Y	7012	8 496	27 107	31 671	36 579	43 140
Z	6542	9 362	11 018	33 606	38 601	43 963

What are the correct identities of these three elements?

	element X	element Y	element Z
A	Na	Mg	Al

Question 2

B	Mg	<i>Al</i>	Si
C	P	S	<i>Cl</i>
D	S	<i>Cl</i>	Ar

Solution 2

Answer: **C**

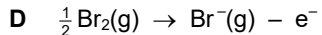
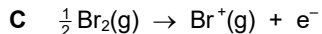
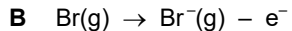
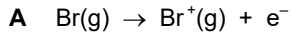
Why

- Find where each element's ionisation energy jumps sharply – that is where an inner shell is broken into.
- X jumps after the 5th, so it has 5 outer electrons; Y jumps after the 6th and Z after the 7th.
- Five, six and seven outer electrons in Period 3 means phosphorus, sulfur and chlorine.

Question 2

9701/12 N25 ■ Q2 ■ 1 mark

2 Which equation has an energy change that is equal to the first ionisation energy of bromine?



Solution 2

Answer: **A**

Why

- First ionisation energy is defined for one mole of *gaseous atoms* each losing one electron.
- So the equation must start from Br(g) , not from $\frac{1}{2}\text{Br}_2(\text{g})$.
- And it must form a positive ion by losing an electron, which rules out the Br^- options.

Question 7

9701/12 N25 ■ Q7 ■ 1 mark

- 7 X and Y are different elements in Period 3.

Atoms of X and Y each have only one completely filled orbital in their highest occupied energy sub-shell.

Y has a greater first ionisation energy than X.

Which row shows the structure and bonding in X and Y?

	X	Y
A	giant metallic	giant metallic
B	giant metallic	simple molecular
C	giant covalent	simple molecular
D	simple molecular	simple molecular

Question 7

Solution 7

Answer: **B**

Why

- Only Mg ($3s^2$) and S ($3s^2 3p^4$) have exactly one *full* orbital in their outermost sub-shell.
- Sulfur has the higher first ionisation energy, so Y is sulfur and X is magnesium.
- Magnesium is giant metallic; sulfur exists as S_8 molecules, so it is simple molecular.

Question 2

9701/13 N25 ■ Q2 ■ 1 mark

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Solution 2

Answer: **C**

Why

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