



# A' Level Chemistry

## Year 1

### Paper 1 Multiple Choice

## Summer Examination Revision Pack

The questions in this pack should be attempted **AFTER** completing all other revision.



#### Grade Accelerator

*Recall Definitions*  
*Drawing Diagrams*  
*Using Equations*  
*Drawing Graphs*



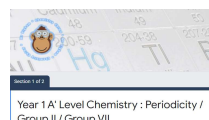
#### Condensed Notes

*Keywords & Definitions*  
*Key Concepts*  
*Application*  
*Key Skills*

#### Quizlet

#### Quizlet Classes

*Flashcard Based*  
*Games*  
*Tests & Quizzes*  
*Keyword Spell Checker*



#### Online Forms

*Take Time to Answer*  
*Use Paper & Calculator*  
*Work It Out*  
*Review Missed Marks*

Use the 3 Wave Process when completing these revision packs.



1. Complete the questions without assistance  
(Can't answer a question? Leave it and move on)
2. Use your notes to fill any gaps after step 1
3. Use the mark scheme to fill in any remaining gaps.

**1. Having gaps after step 1 is normal, that's why we are doing revision!**

2. If your notes don't help during step 2, they are not good enough!  
(Change your note taking method and try to understand the problem)
3. If you don't understand why the mark scheme answer is correct, **see Andy.**



If you struggle with the questions in the pack, **STOP!** and complete some more revision.



If you come to a complete dead-end, **STOP!** and speak to **Andy** asap.

## Section B

Answer **all** questions in the spaces providedOnly **one** answer per question is allowed.

For each answer completely fill in the circle alongside the appropriate answer.

CORRECT METHOD 

WRONG METHODS



If you want to change your answer you must cross out your original answer as shown.

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1 0

Which element is in the d-block of the Periodic Table?

[1 mark]

A Selenium

B Antimony

C Tantalum

D Lead

1 1

Which species contains an element with an oxidation state of +4?

[1 mark]

A  $\text{NO}_2^+$ B  $\text{ClO}_3^-$ C  $\text{H}_2\text{SO}_3$ D  $\text{PCl}_5$ 

**1 2**

There are 392 mol of pure gold in a bar measuring 10 cm by 10 cm by 40 cm.  
What is the density of gold in  $\text{kg dm}^{-3}$ ?

**[1 mark]****A** 193**B** 19.3**C** 1.93**D** 0.193**1 3**

Ions of two isotopes of iron are



Which statement is correct?

**[1 mark]**

**A** The ions of both the isotopes have the electronic configuration  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^6$

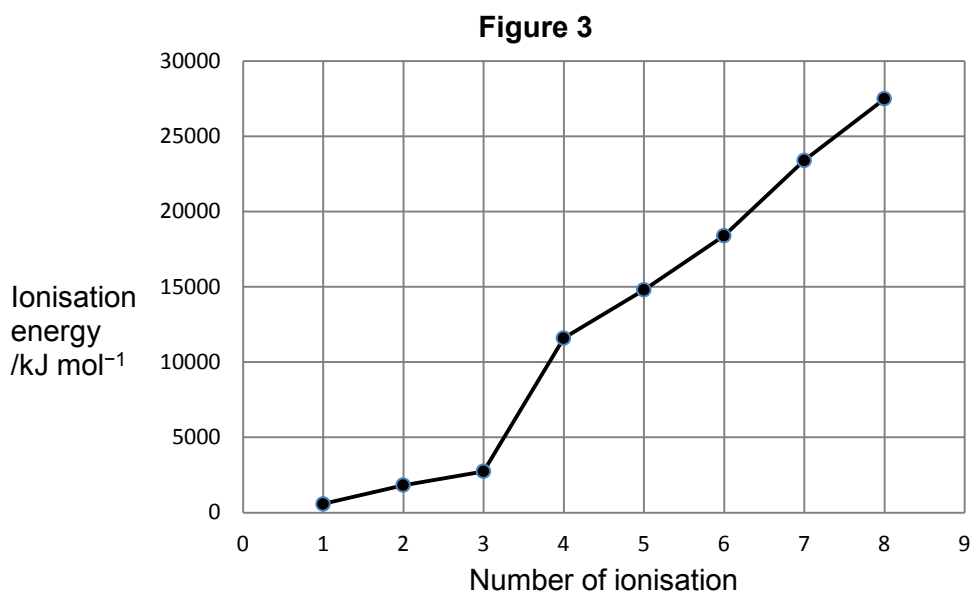
**B** The ions of both the isotopes contains 26 neutrons

**C**  $^{53}\text{Fe}^{2+}$  has fewer protons than  $^{56}\text{Fe}^{2+}$

**D** After acceleration to the same kinetic energy  $^{56}\text{Fe}^{2+}$  will move more slowly than  $^{53}\text{Fe}^{2+}$



1 4

The successive ionisation energies for element X are shown in **Figure 3**.

Which element is X?

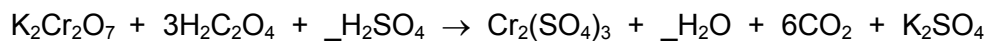
**[1 mark]****A** Nitrogen**B** Phosphorus**C** Aluminium**D** Boron

1 5

Which of these decreases down Group 2?

**[1 mark]****A** First ionisation energy**B** Atomic radius**C** Number of protons**D** Reactivity with water

Refer to the unbalanced equation below when answering questions **16** and **17**.

**1 6**

In the balanced equation the mole ratio for sulfuric acid to water is

**A** 1 : 4

**B** 1 : 2

**C** 4 : 7

**D** 4 : 9

**[1 mark]****1 7**

What is the reducing agent in this reaction?

**A**  $\text{H}^+$

**B**  $\text{C}_2\text{O}_4^{2-}$

**C**  $\text{K}^+$

**D**  $\text{Cr}_2\text{O}_7^{2-}$

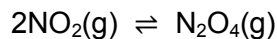
**[1 mark]**

**1 8**

Which substance exists as a macromolecule?

**[1 mark]****A** Cu**B** SiO<sub>2</sub>**C** P<sub>4</sub>O<sub>10</sub>**D** MgO**1 9**

A pale brown mixture of NO<sub>2</sub> and N<sub>2</sub>O<sub>4</sub> is allowed to reach equilibrium in a sealed gas syringe according to the following equation.



When the plunger is pushed further into the syringe the pressure increases and the mixture becomes paler in colour.

When the syringe is placed in a hot oven the mixture becomes darker in colour.

Which of the following statements is correct?

**[1 mark]****A** NO<sub>2</sub> is brown and the forward reaction is exothermic.**B** NO<sub>2</sub> is brown and the forward reaction is endothermic.**C** NO<sub>2</sub> is colourless and the forward reaction is exothermic.**D** NO<sub>2</sub> is colourless and the forward reaction is endothermic.

2	0
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Which molecule has the largest dipole?

A  $\text{ClF}_3$ B  $\text{BF}_3$ C  $\text{SF}_6$ D  $\text{CF}_4$ 

[1 mark]

2	1
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In a molecule of a hydrocarbon, the fraction by mass of carbon is  $\frac{9}{11}$ 

What is the empirical formula of the hydrocarbon?

A CH

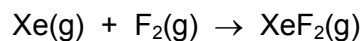
B  $\text{CH}_3$ C  $\text{C}_3\text{H}_8$ D  $\text{C}_5\text{H}_{12}$ 

[1 mark]



**2 2**

30 cm<sup>3</sup> of xenon are mixed with 20 cm<sup>3</sup> of fluorine. The gases react according to the following equation. Assume that the temperature and pressure remain constant.



What is the final volume of gas after the reaction is complete?

**A** 50 cm<sup>3</sup>

**B** 40 cm<sup>3</sup>

**C** 30 cm<sup>3</sup>

**D** 20 cm<sup>3</sup>

**[1 mark]****2 3**

Which of the following solutions would react exactly with a solution containing 0.0500 mol sulfuric acid?

**A** 50.0 cm<sup>3</sup> of 1.00 mol dm<sup>-3</sup> KOH

**B** 100.0 cm<sup>3</sup> of 2.00 mol dm<sup>-3</sup> KOH

**C** 100.0 cm<sup>3</sup> of 2.00 mol dm<sup>-3</sup> Ba(OH)<sub>2</sub>

**D** 50.0 cm<sup>3</sup> of 1.00 mol dm<sup>-3</sup> Ba(OH)<sub>2</sub>

**[1 mark]**

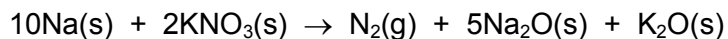


**2 4**

In a car airbag, sodium azide ( $\text{NaN}_3$ ) decomposes to form sodium metal and nitrogen gas.



The sodium metal then reacts with potassium nitrate to produce more nitrogen gas.



If 2.00 mol of sodium azide react in this way, how many molecules of  $\text{N}_2$  will be formed?

(The Avogadro constant  $L = 6.022 \times 10^{23} \text{ mol}^{-1}$ )

**[1 mark]**

**A**  $2.41 \times 10^{24}$

**B**  $1.93 \times 10^{24}$

**C**  $1.81 \times 10^{24}$

**D**  $9.63 \times 10^{23}$

**END OF QUESTIONS**



Question	Marking Guidance	Mark	Comments
10.0	C	1	
11.0	C	1	
12.0	B	1	
13.0	D	1	
14.0	C	1	
15.0	A	1	
16.0	C	1	
17.0	B	1	
18.0	B	1	
19.0	A	1	
20.0	A	1	
21.0	C	1	
22.0	C	1	
23.0	D	1	
24.0	B	1	

## Section B

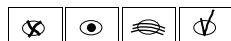
Answer **all** questions in this section.Only **one** answer per question is allowed.

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CORRECT METHOD



WRONG METHODS



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Do **not** use additional sheets for this working.

0 9

Which is the correct crystal structure for the substance named?

[1 mark]

	Substance	Structure	
A	Iodine	Simple molecular	<input type="checkbox"/>
B	Diamond	Ionic	<input type="checkbox"/>
C	Sodium chloride	Giant covalent	<input type="checkbox"/>
D	Graphite	Metallic	<input type="checkbox"/>

1 0

Which is the best technique to remove the silver chloride that forms when aqueous solutions of silver nitrate and sodium chloride react?

[1 mark]

- A Refluxing
- B Evaporation
- C Filtration
- D Distillation



1 1

Which statement about astatine is correct?

**[1 mark]**

- A Astatine has a greater electronegativity than bromine
- B Astatine is a better oxidising agent than bromine
- C Astatine has a greater boiling point than bromine
- D Astatine has a greater first ionisation energy than bromine

1 2

Which statement about time of flight mass spectrometry is correct?

**[1 mark]**

- A The current in the detector is proportional to the ion abundance
- B Sample particles gain electrons to form positive ions
- C Particles are detected in the order of their kinetic energies
- D Ions are accelerated by a magnetic field

1 3

Chlorine exists as two isotopes  $^{35}\text{Cl}$  and  $^{37}\text{Cl}$  in the ratio 3:1Which statement about peaks in the mass spectrum of  $\text{Cl}_2$  is correct?**[1 mark]**

- A Peaks at  $m/z = 70$  and  $74$  in the ratio 3:1
- B Peaks at  $m/z = 70, 72$  and  $74$  in the ratio 9:6:1
- C Peaks at  $m/z = 70, 72$  and  $74$  in the ratio 9:3:1
- D Peaks at  $m/z = 70$  and  $72$  in the ratio 3:1



1 4

A 4.85 g sample of anhydrous sodium sulfate is dissolved in water and the solution made up to 250 cm<sup>3</sup> in a volumetric flask.

What is the concentration in mol dm<sup>-3</sup> of sodium sulfate in the solution?

**[1 mark]**

A 0.0341

B 0.137

C 0.163

D 0.273

1 5

Which of these contains the greatest number of atoms?

**[1 mark]**

A 127 mg of iodine

B  $1.54 \times 10^{-4}$  kg of phosphorus

C 81.0 mg of carbon dioxide

D  $1.70 \times 10^{-4}$  kg of ammonia

1 6

25.0 cm<sup>3</sup> samples of NaOH solution were taken by pipette from a beaker. These were then titrated with an aqueous solution of ethanoic acid. The concentration of ethanoic acid calculated from the experimental results was found to be lower than the actual value.

Which of these could explain the difference?

**[1 mark]**

A Rinsing the pipette with distilled water before filling with NaOH

B Rinsing the burette with distilled water before filling with ethanoic acid

C Rinsing the walls of the conical flask with distilled water during the titration

D Rinsing the beaker with distilled water before filling with NaOH



1 7

A 20.0 cm<sup>3</sup> sample of a 0.400 mol dm<sup>-3</sup> aqueous solution of a metal bromide (MBr<sub>n</sub>) reacts exactly with 160 cm<sup>3</sup> of 0.100 mol dm<sup>-3</sup> aqueous silver nitrate.

What is the formula of the metal bromide?

[1 mark]

- A MBr
- B MBr<sub>2</sub>
- C MBr<sub>3</sub>
- D MBr<sub>4</sub>

1 8

Which species has one or more bond angle(s) of 90°?

[1 mark]

- A CH<sub>4</sub>
- B NH<sub>4</sub><sup>+</sup>
- C ClF<sub>4</sub><sup>-</sup>
- D AlCl<sub>4</sub><sup>-</sup>

1 9

The forward reaction in this equilibrium is endothermic



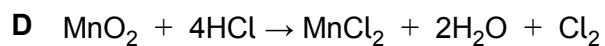
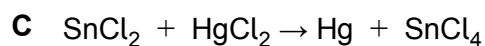
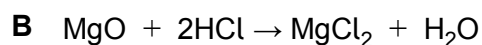
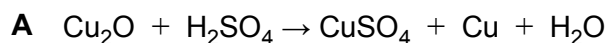
Which statement is correct?

[1 mark]

- A If the total pressure is increased at constant temperature, the proportion of COCl<sub>2</sub> in the equilibrium mixture will decrease
- B Use of a catalyst will increase the proportion of COCl<sub>2</sub> in the equilibrium mixture at constant temperature and pressure
- C Reducing the equilibrium concentration of CO will increase the value of the equilibrium constant
- D Raising the temperature from 373 K to 473 K will increase the value of the equilibrium constant



2	0
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Which of these is **not** a redox reaction?**[1 mark]**

2	1
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Which of these has the highest first ionisation energy?

**[1 mark]**

A Na

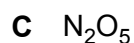
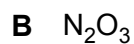
B Al

C Si

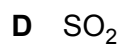
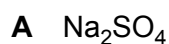
D Cl

2	2
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What is the empirical formula of an oxide of nitrogen that contains 26% nitrogen by mass?

**[1 mark]**

2	3
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Which species is **not** produced by a redox reaction between solid sodium iodide and concentrated sulfuric acid?**[1 mark]**

END OF QUESTIONS

15
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9	A
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10	C
----	---

11	C
----	---

12	A
----	---

13	B
----	---

14	B
----	---

15	D
----	---

16	B
----	---

17	B
----	---

18	C
----	---



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19	D
----	---

20	B
----	---

21	D
----	---

22	C
----	---

23	A
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## Section B

Answer **all** questions in this section.Only **one** answer per question is allowed.

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CORRECT METHOD



WRONG METHODS



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1 0

Which row shows the bonding in ammonium chloride?

[1 mark]

	Covalent	Dative covalent	Ionic	
A	✓	x	x	<input type="radio"/>
B	✓	✓	x	<input type="radio"/>
C	✓	✓	✓	<input type="radio"/>
D	x	x	✓	<input type="radio"/>

1 1

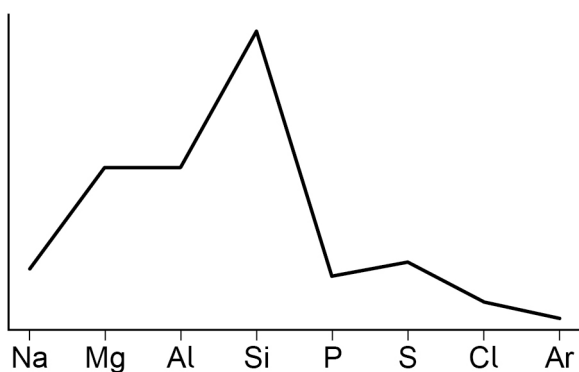
How many protons are there in 6.0 g of nitrogen gas?

Avogadro constant,  $L = 6.022 \times 10^{23} \text{ mol}^{-1}$ 

[1 mark]

A  $1.3 \times 10^{23}$ B  $9.0 \times 10^{23}$ C  $1.8 \times 10^{24}$ D  $3.6 \times 10^{24}$ 

**1 2** The diagram shows how a property of Period 3 elements varies across the period.

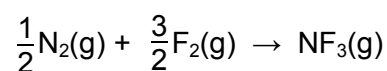


What is the property?

[1 mark]

- A** Atomic radius
- B** Electronegativity
- C** First ionisation energy
- D** Melting point

**1 3** A 30 cm<sup>3</sup> sample of nitrogen was reacted with a 60 cm<sup>3</sup> sample of fluorine according to the equation



What is the volume of the gas mixture after the reaction, at constant temperature and pressure?

[1 mark]

- A** 20 cm<sup>3</sup>
- B** 30 cm<sup>3</sup>
- C** 40 cm<sup>3</sup>
- D** 50 cm<sup>3</sup>

Turn over ►



**1 4** Which substance is used to reduce titanium(IV) chloride in the extraction of titanium metal?

[1 mark]

- A Magnesium
- B Manganese
- C Vanadium
- D Zinc

**1 5** Which statement about barium sulfate is correct?

[1 mark]

- A It is soluble in water at a temperature of 100 °C.
- B It is used in medicine because it does not dissolve in body fluids.
- C It is a pale yellow solid.
- D It reacts with acidified barium chloride solution.

**1 6** Which statement is correct about the reaction between concentrated sulfuric acid and solid sodium bromide?

[1 mark]

- A Bromide ions are reduced.
- B Hydrogen bromide and sulfur are formed.
- C Sulfuric acid acts as an oxidising agent.
- D Bromine and hydrogen sulfide are formed.



**1 7** Which compound is used to treat the symptoms of indigestion?

[1 mark]

A MgO

B Mg(OH)<sub>2</sub>

C CaO

D Ca(OH)<sub>2</sub>

**1 8** Which element has the highest first ionisation energy?

[1 mark]

A Aluminium

B Phosphorus

C Silicon

D Sulfur

**1 9** A solution of volume 500 cm<sup>3</sup> contains 150 g of ammonia.

What is the concentration, in mol dm<sup>-3</sup>, of ammonia in this solution?

[1 mark]

A 0.51

B 8.82

C 16.7

D 17.6

Turn over ►



Refer to the following information when answering Questions 20, 21, 22, 23 and 24.

A student devised an experiment to find the concentration of sulfuric acid in a sample of battery acid.

- A measuring cylinder was used to transfer  $10\text{ cm}^3$  of battery acid to a volumetric flask.
- Distilled water was added to the volumetric flask until the volume reached  $250\text{ cm}^3$
- A  $25.0\text{ cm}^3$  sample of diluted acid was transferred from the volumetric flask to a conical flask using a pipette.
- A few drops of methyl orange indicator were added to the acid in the conical flask before titrating the acid with sodium hydroxide.
- The titration was repeated five times but concordant results were **not** obtained. (Note: Methyl orange is red in acid and yellow in alkali.)

2 0

Which suggestion would improve the chances of obtaining concordant titres?

[1 mark]

- A Invert the volumetric flask several times after adding the distilled water.
- B Wash the pipette with distilled water between each titration.
- C Add extra drops of indicator to the sample when nearing the end point in each titration.
- D Use a more concentrated solution of sodium hydroxide in the burette.

2 1

Which suggestion about rinsing the conical flask between each titration would improve the accuracy of the titrations?

[1 mark]

- A Rinsing with acid.
- B Rinsing with alkali.
- C Rinsing with water.
- D No rinsing with any liquid.



**2 2** Which suggestion would reduce the overall measurement uncertainty in the titration?

[1 mark]

- A** Use less concentrated alkali in the burette.
- B** Use phenolphthalein indicator instead of methyl orange.
- C** Use smaller samples of the diluted acid in each titration.
- D** Begin each titration with the burette filled to the 0.00 cm<sup>3</sup> mark.

**2 3** Which of these is important in ensuring that the student's experiment is safe?

[1 mark]

- A** Do the titration in a fume cupboard.
- B** Wear gloves when measuring out the battery acid.
- C** Wash hands before doing the titration.
- D** Carry the burette horizontally when collecting the apparatus.

**2 4** Which colour change is observed at the end point in each titration?

[1 mark]

- A** Yellow to red
- B** Red to orange
- C** Yellow to orange
- D** Red to yellow

15

**END OF QUESTIONS**



Question	Marking Guidance
10	C
11	C
12	D
13	D
14	A
15	B
16	C
17	B
18	B



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Question	Marking Guidance
19	D
20	A
21	C
22	A
23	B
24	B

## Section B

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CORRECT METHOD



WRONG METHODS



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0 9

Which sample, measured at room temperature and pressure, contains the greatest number of the stated particles?

[1 mark]

A 1 g of hydrogen molecules

B 1 g of helium atoms

C 1 dm<sup>3</sup> of hydrogen moleculesD 1 dm<sup>3</sup> of helium atoms

1 0

5.0 g of an oxide of molybdenum contain 4.0 g of molybdenum.

What is the empirical formula of this oxide?

[1 mark]

A MoO<sub>2</sub>B Mo<sub>4</sub>O<sub>5</sub>C Mo<sub>2</sub>O<sub>3</sub>D Mo<sub>3</sub>O<sub>2</sub>

1 1

Which substance has delocalised electrons?

[1 mark]

A graphite

B iodine

C sodium chloride

D tetrachloromethane

1 2

Which species is **not** pyramidal in shape?

[1 mark]

A  $\text{PF}_3$ B  $\text{H}_3\text{O}^+$ C  $\text{CH}_3^-$ D  $\text{BF}_3$ 

1 3

Which change occurs when water is vaporised?

[1 mark]

A An exothermic change occurs.

B Covalent bonds are broken.

C Intermolecular forces are overcome.

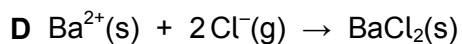
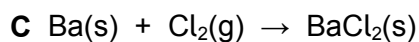
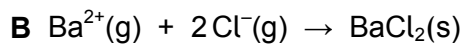
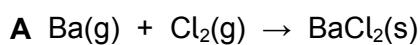
D The total energy of the molecules decreases.

Turn over ►

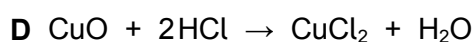
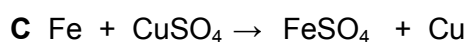
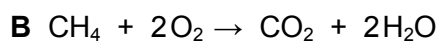
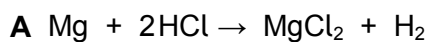


**1 4**

Which equation represents the reaction that has a standard enthalpy change equal to the standard enthalpy of formation for barium chloride?

**[1 mark]****1 5**

Which equation does **not** represent a redox reaction?

**[1 mark]****1 6**

Which property would you expect the element radium, Ra, to possess?

**[1 mark]**

**A** It forms a soluble sulfate.

**B** It does not react with water.

**C** It is a good conductor of electricity.

**D** It forms a covalent fluoride.



1 7

Which statement is **not** correct?

[1 mark]

- A Strontium has a lower first ionisation energy than calcium.
- B Strontium has a larger ionic radius than calcium.
- C Strontium reacts less vigorously with water than calcium.
- D Strontium hydroxide is more soluble in water than calcium hydroxide.

1 8

Which property of the Group 2 elements, Ca to Ba, increases with increasing atomic number?

[1 mark]

- A Atomic Radius
- B Electronegativity
- C First ionisation energy
- D Melting Point

1 9

What is the best oxidising agent?

[1 mark]

- A  $F_2$
- B  $F^-$
- C  $I_2$
- D  $I^-$

Turn over ►



**2 0**

Some fuel in a spirit burner is burned, and the heat produced is used to heat a container of water.

In this experiment:

The mass of water heated =  $m$  g

The temperature rise =  $y$  °C

The specific heat capacity of water =  $c$  J K<sup>-1</sup> g<sup>-1</sup>

What is the amount of heat energy absorbed by the water?

**[1 mark]**

**A**  $mcy$

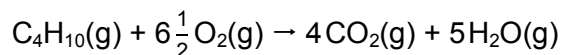
**B**  $mc(y + 273)$

**C**  $y / mc$

**D**  $(y + 273) / mc$

**2 1**

The equation below represents the complete combustion of butane.



20 cm<sup>3</sup> of butane are completely burned in 0.20 dm<sup>3</sup> of oxygen.  
Which statement is correct?

All volumes are measured at the same temperature and pressure.

**[1 mark]**

**A** 40 cm<sup>3</sup> of carbon dioxide are formed

**B** 0.065 dm<sup>3</sup> of oxygen react

**C** 70 cm<sup>3</sup> of oxygen remain

**D** 0.50 dm<sup>3</sup> of steam are formed



2	2
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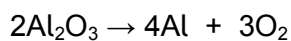
Which statement is correct about reactions involving halide ions?

**[1 mark]**

- A** Sodium chloride forms chlorine when added to concentrated sulfuric acid.
- B** Sodium chloride forms chlorine when added to bromine.
- C** Sodium bromide forms bromine when added to concentrated sulfuric acid.
- D** Sodium bromide forms bromine when added to iodine.

2	3
---	---

What is the percentage yield when 20 g of aluminium are produced from 50 g of aluminium oxide?

**[1 mark]**

- A** 76%
- B** 40%
- C** 33%
- D** 19%

15
----

**END OF QUESTIONS**

<b>Question</b>	<b>Marking Guidance</b>	<b>Mark</b>	<b>Comments</b>
9	<b>A</b>	1	
10	<b>C</b>	1	
11	<b>A</b>	1	
12	<b>D</b>	1	
13	<b>C</b>	1	
14	<b>C</b>	1	
15	<b>D</b>	1	
16	<b>C</b>	1	
17	<b>C</b>	1	
18	<b>A</b>	1	
19	<b>A</b>	1	
20	<b>A</b>	1	
21	<b>C</b>	1	
22	<b>C</b>	1	
23	<b>A</b>	1	



## Section B

Answer **all** questions in this section.Only **one** answer per question is allowed.

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CORRECT METHOD



WRONG METHODS



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0 9

Which atom has the smallest number of neutrons?

[1 mark]

A  $^3\text{H}$ B  $^4\text{He}$ C  $^5\text{He}$ D  $^4\text{Li}$ 

1 0

Which species contains bonds that have different polarities?

[1 mark]

A  $\text{NH}_4^+$ B  $\text{CCl}_4$ C  $\text{CH}_3\text{Cl}$ D  $\text{H}_3\text{O}^+$ 

Turn over ►



**1 1**

Which compound has hydrogen bonding?

**[1 mark]****A** NaH**B** NH<sub>3</sub>**C** HI**D** SiH<sub>4</sub>**1 2**

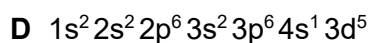
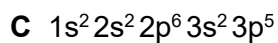
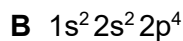
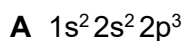
Which reaction has an enthalpy change equal to the standard enthalpy of formation of lithium fluoride?

**[1 mark]****A**  $\text{Li(g)} + \frac{1}{2}\text{F}_2\text{(g)} \rightarrow \text{LiF(s)}$ **B**  $\text{Li}^+\text{(g)} + \text{F}^-\text{(g)} \rightarrow \text{LiF(s)}$ **C**  $\text{Li}^+\text{(aq)} + \text{F}^-\text{(aq)} \rightarrow \text{LiF(s)}$ **D**  $\text{Li(s)} + \frac{1}{2}\text{F}_2\text{(g)} \rightarrow \text{LiF(s)}$ **1 3**NO<sub>2</sub><sup>-</sup> ions can be reduced in acidic solution to NO  
How many electrons are gained when each NO<sub>2</sub><sup>-</sup> ion is reduced?**[1 mark]****A** 1**B** 2**C** 3**D** 4

1 4

Which is the electron configuration of an atom with **only two** unpaired electrons?

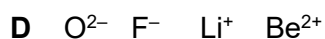
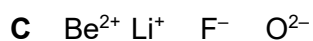
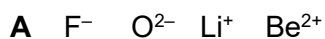
[1 mark]



1 5

Which represents the correct order of increasing radius of the ions?

[1 mark]



1 6

Which compound contains a co-ordinate bond?

[1 mark]



Turn over ►



1 7

Which property increases down Group 7?

[1 mark]

- A ability to oxidise a given reducing agent
- B boiling point
- C electronegativity
- D first ionisation energy

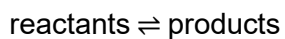
1 8

Which of these elements has the highest melting point?

[1 mark]

- A Argon
- B Chlorine
- C Silicon
- D Sulfur

1 9

Which statement is **not** always correct for a reaction at equilibrium?

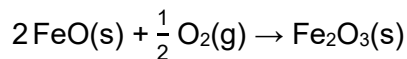
[1 mark]

- A The concentrations of the reactants and products are equal.
- B The equilibrium can be achieved starting from the reactants.
- C The equilibrium can be achieved starting from the products.
- D The rate of the forward reaction is equal to the rate of the reverse reaction.



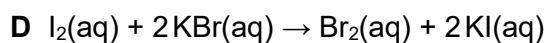
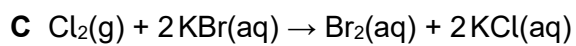
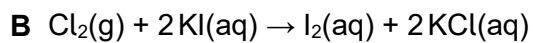
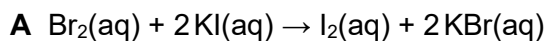
**2 0**

Two reactions of iron with oxygen are shown.

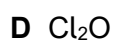
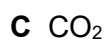
What is the enthalpy change, in  $\text{kJ mol}^{-1}$ , for this reaction?**[1 mark]****A** +550**B** -278**C** -1094**D** -1372**2 1**

Which compound contains chlorine in an oxidation state of +1?

**[1 mark]****A**  $\text{Cl}_2\text{O}$ **B**  $\text{KClO}_3$ **C**  $\text{ClF}_3$ **D**  $\text{CCl}_4$ **Turn over for the next question****Turn over ►**

**2 2**Which equation shows a redox reaction that does **not** occur?**[1 mark]****2 3**

Which molecule has a permanent dipole?

**[1 mark]****15****END OF QUESTIONS**

Question	Marking Guidance	Mark	Comments
9	D	1	${}^4\text{Li}$
10	C	1	$\text{CH}_3\text{Cl}$
11	B	1	$\text{NH}_3$
12	D	1	$\text{Li(s)} + \frac{1}{2} \text{F}_2\text{(g)} \rightarrow \text{LiF(s)}$
13	A	1	1
14	B	1	$1s^2 2s^2 2p^4$
15	C	1	$\text{Be}^{2+} \text{ Li}^+ \text{ F}^- \text{ O}^{2-}$
16	D	1	$\text{NH}_4\text{Cl}$
17	B	1	boiling point
18	C	1	Silicon
19	A	1	The concentrations of the reactants and products are equal.
20	B	1	-278
21	A	1	$\text{Cl}_2\text{O}$
22	D	1	$\text{I}_2\text{(aq)} + 2 \text{KBr(aq)} \rightarrow \text{Br}_2\text{(aq)} + 2\text{KI(aq)}$
23	D	1	$\text{Cl}_2\text{O}$

## Section B

Answer **all** questions in this section.Only **one** answer per question is allowed.

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CORRECT METHOD



WRONG METHODS



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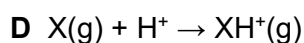
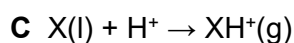
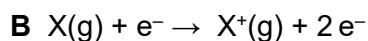
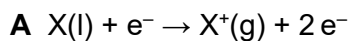
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1 | 1

In a time of flight mass spectrometer, molecule X is ionised using electrospray ionisation.

What is the equation for this ionisation?

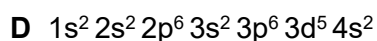
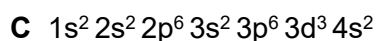
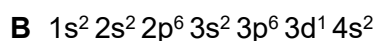
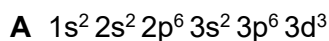
[1 mark]



1 | 2

What is the electron configuration of  $V^{2+}$  in the ground state?

[1 mark]





**1 3**Which molecule is **not** able to form a co-ordinate bond with another species?**[1 mark]****A**  $\text{BH}_3$ **B**  $\text{CH}_4$ **C**  $\text{NH}_3$ **D**  $\text{H}_2\text{O}$ **1 4**

Which species has a square planar shape?

**[1 mark]****A**  $\text{NH}_4^+$ **B**  $\text{SF}_4$ **C**  $\text{XeF}_4$ **D**  $\text{PCl}_4^+$ **1 5**

Which bond has the most unsymmetrical electron distribution?

**[1 mark]****A**  $\text{H-O}$ **B**  $\text{H-S}$ **C**  $\text{H-N}$ **D**  $\text{H-P}$ **Turn over for the next question****Turn over ►**

**1 6**

Which compound contains a chlorine atom with an oxidation state of +4?

**[1 mark]****A**  $\text{KClO}_4$ **B**  $\text{CCl}_4$ **C**  $\text{ClO}_2$ **D**  $\text{ClO}_2\text{F}$ **1 7**

Which element is classified as a d block element?

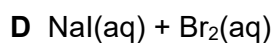
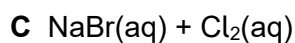
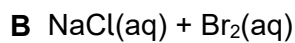
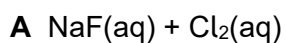
**[1 mark]****A** Antimony**B** Molybdenum**C** Strontium**D** Uranium**1 8**

Which element in Period 3 has the highest melting point?

**[1 mark]****A** Aluminium**B** Silicon**C** Sodium**D** Sulfur

**1 9**

Which pair of solutions, when mixed, reacts to form a dark brown solution?

**[1 mark]****2 0**

Some solid sodium halides are reacted with concentrated sulfuric acid.

Which solid sodium halide does **not** produce a sulfur-containing gas as one of the products?

**[1 mark]**

**Turn over for the next question**

**Turn over ►**

2	1
---	---

Which atom has one more proton and two more neutrons than  ${}_{15}^{31}\text{P}$ ?

**[1 mark]**

2	2
---	---

What is a use for barium sulfate?

**[1 mark]**

A In agriculture to act as a fertiliser

B In agriculture to neutralise acidic soil

C In medicine to produce an X-ray image

D In medicine as an antacid to treat indigestion

2	3
---	---

Which ion has the largest radius?

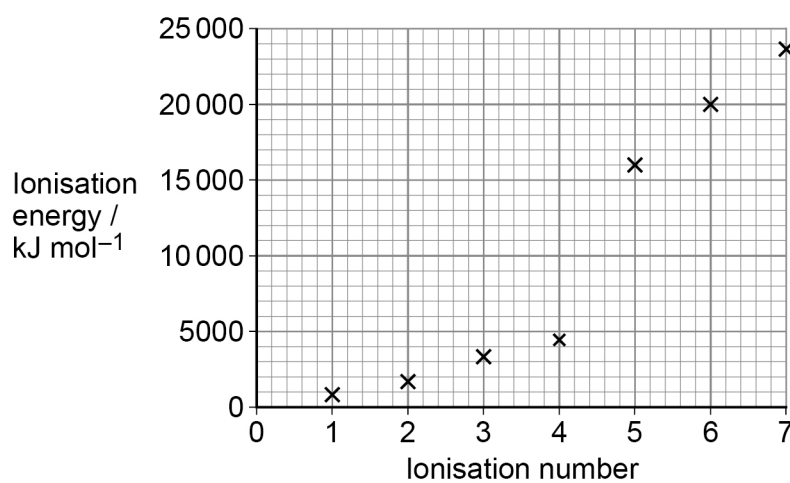
**[1 mark]**

**2 4**

Which element has a first ionisation energy lower than that of sulfur?

**[1 mark]****A** Chlorine**B** Oxygen**C** Phosphorus**D** Selenium**2 5**

The first seven successive ionisation energies for element Z are shown.



What is element Z?

**[1 mark]****A** Carbon**B** Nitrogen**C** Silicon**D** Phosphorus**15****END OF QUESTIONS**

Question	Marking Guidance	Mark	Comments
11	D	1	$X(g) + H^+ \rightarrow XH^+(g)$
12	A	1	$1s^2 2s^2 2p^6 3s^2 3p^6 3d^3$
13	B	1	CH <sub>4</sub>
14	C	1	XeF <sub>4</sub>
15	A	1	H–O
16	C	1	ClO <sub>2</sub>
17	B	1	Molybdenum
18	B	1	Silicon
19	D	1	$NaI(aq) + Br_2(aq)$
20	A	1	NaCl
21	D	1	$^{34}_{16}S$
22	C	1	In medicine to produce an X-ray image
23	D	1	O <sup>2-</sup>
24	D	1	Selenium
25	C	1	Silicon

## Section B

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WRONG METHODS



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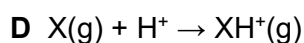
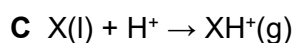
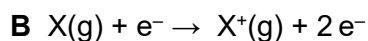
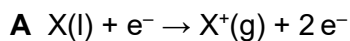
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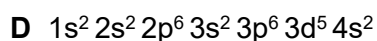
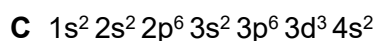
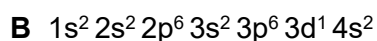
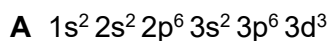
[1 mark]



1 | 2

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[1 mark]



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Turn over for the next question

Turn over ►





**1 6**

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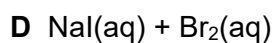
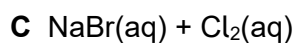
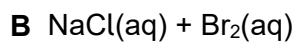
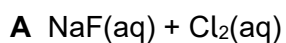
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**[1 mark]****2 0**

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Which solid sodium halide does **not** produce a sulfur-containing gas as one of the products?

**[1 mark]**

**Turn over for the next question**

**Turn over ►**

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What is a use for barium sulfate?

**[1 mark]****A** In agriculture to act as a fertiliser**B** In agriculture to neutralise acidic soil**C** In medicine to produce an X-ray image**D** In medicine as an antacid to treat indigestion**2 3**

Which ion has the largest radius?

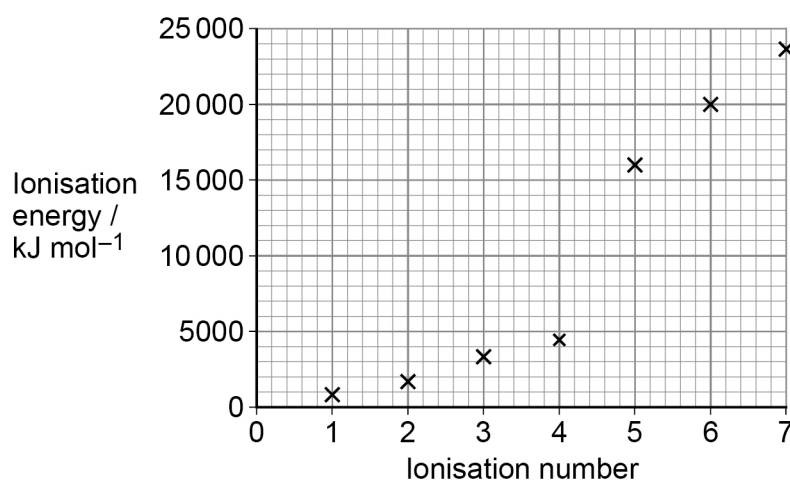
**[1 mark]**

**2 4**

Which element has a first ionisation energy lower than that of sulfur?

**[1 mark]****A** Chlorine**B** Oxygen**C** Phosphorus**D** Selenium**2 5**

The first seven successive ionisation energies for element Z are shown.



What is element Z?

**[1 mark]****A** Carbon**B** Nitrogen**C** Silicon**D** Phosphorus**15****END OF QUESTIONS**

Question	Marking Guidance	Mark	Comments
11	D	1	$X(g) + H^+ \rightarrow XH^+(g)$
12	A	1	$1s^2 2s^2 2p^6 3s^2 3p^6 3d^3$
13	B	1	CH <sub>4</sub>
14	C	1	XeF <sub>4</sub>
15	A	1	H–O
16	C	1	ClO <sub>2</sub>
17	B	1	Molybdenum
18	B	1	Silicon
19	D	1	NaI(aq) + Br <sub>2</sub> (aq)
20	A	1	NaCl
21	D	1	$^{34}_{16}\text{S}$
22	C	1	In medicine to produce an X-ray image
23	D	1	O <sup>2-</sup>
24	D	1	Selenium
25	C	1	Silicon

## Section B



Answer **all** questions in this section.Only **one** answer per question is allowed.

For each answer completely fill in the circle alongside the appropriate answer.

CORRECT METHOD



WRONG METHODS

If you want to change your answer you must cross out your original answer as shown. If you wish to return to an answer previously crossed out, ring the answer you now wish to select as shown. You may do your working in the blank space around each question but this will not be marked.  
Do **not** use additional sheets for this working.

0 9

Which atom has two more protons and two more neutrons than  $^{52}_{24}\text{Cr}$ ?

[1 mark]

A  $^{54}_{26}\text{Cr}$  B  $^{56}_{26}\text{Cr}$  C  $^{54}_{26}\text{Fe}$  D  $^{56}_{26}\text{Fe}$  

1 0

An atom has all its electrons in their lowest energy levels.

Which atom contains only two unpaired electrons?

[1 mark]

A Helium B Beryllium C Oxygen D Iron 

1 1

The first six ionisation energies, in  $\text{kJ mol}^{-1}$ , of an element are:

1090, 2350, 4610, 6220, 37 800, 47 000

What is the element?

[1 mark]

A Boron

B Carbon

C Nitrogen

D Oxygen

1 2

In which pair is the first ionisation energy of atom Y greater than that of atom X?

[1 mark]

	Electron configuration of atom X	Electron configuration of atom Y	
A	$1s^22s^2$	$1s^22s^22p^1$	<input type="checkbox"/>
B	$1s^22s^22p^3$	$1s^22s^22p^4$	<input type="checkbox"/>
C	$1s^22s^22p^5$	$1s^22s^22p^6$	<input type="checkbox"/>
D	$1s^22s^22p^6$	$1s^22s^22p^63s^1$	<input type="checkbox"/>

1 3

Which statement about isotopes of an element is **not** correct?

[1 mark]

A They have the same chemical properties.

B They have the same number of electrons in ions of the same charge.

C They have the same number of neutrons.

D They have the same number of protons.

Turn over ►



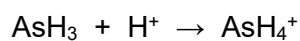
**1 4**

5.0 g of an oxide contains 4.0 g of molybdenum.

What is the empirical formula of this oxide?

**[1 mark]**A MoO<sub>2</sub> B MoO<sub>5</sub> C Mo<sub>2</sub>O<sub>3</sub> D Mo<sub>3</sub>O<sub>2</sub> **1 5**

The equation for a reaction is



What type of interaction forms in this reaction?

**[1 mark]**A Co-ordinate bond B Dipole–dipole force C Hydrogen bond D Ionic bond **1 6**

Which is a correct trend down Group 7 from fluorine to iodine?

**[1 mark]**A The boiling point of the element decreases. B The oxidising ability of the element decreases. C The electronegativity of the atom increases. D The first ionisation energy of the atom increases. 



**1 7**

Which of these ions has the largest ionic radius?

**[1 mark]****A**  $S^{2-}$  **B**  $Cl^{-}$  **C**  $K^{+}$  **D**  $Ca^{2+}$  **1 8**

Which statement is correct?

**[1 mark]****A** Chloride ions reduce concentrated sulfuric acid to form sulfur dioxide. **B** Bromide ions reduce concentrated sulfuric acid to form sulfur. **C** Bromide ions reduce iodine to form iodide ions. **D** Iodide ions reduce chlorine to form chloride ions. **1 9**

In which of these substances is oxygen in the highest oxidation state?

**[1 mark]****A**  $OF_2$  **B**  $H_2O$  **C**  $O_2$  **D**  $H_2O_2$  **Turn over ►**

**2 0**

Which block in the Periodic Table contains the element samarium (Sm)?

**[1 mark]****A** d block **B** f block **C** p block **D** s block **2 1**Which species is **not** a possible product of the reactions between chlorine and water?**[1 mark]****A**  $\text{Cl}^-$  **B**  $\text{ClO}^-$  **C**  $\text{O}_2$  **D**  $\text{OH}^-$  **2 2**

Which statement is correct?

**[1 mark]****A** Magnesium reacts with steam to give magnesium oxide as one of the products. **B** Magnesium acts as an oxidising agent in the extraction of titanium. **C** Magnesium has a lower melting point than sodium. **D** Magnesium hydroxide is very soluble in water. 

2	3
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Which is **not** responsible for conducting electricity?

[1 mark]

- A** The sodium ions in molten sodium chloride
- B** The electrons between layers of carbon atoms in graphite
- C** The bonding electrons in a metal
- D** The lone pair electrons in liquid water molecules

15
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**END OF QUESTIONS**



Question	Marking Guidance	Mark	Comments			
9	D (AO1)	1	${}^{56}_{26}\text{Fe}$			
10	C (AO1)	1	Oxygen			
11	B (AO3)	1	Carbon			
12	C (AO1)	1	<table border="1"> <tr> <td>C</td> <td><math>1s^22s^22p^5</math></td> <td><math>1s^22s^22p^6</math></td> </tr> </table>	C	$1s^22s^22p^5$	$1s^22s^22p^6$
C	$1s^22s^22p^5$	$1s^22s^22p^6$				
13	C (AO1)	1	They have the same number of neutrons.			
14	C (AO2)	1	$\text{Mo}_2\text{O}_3$			
15	A (AO1)	1	Co-ordinate bond			
16	B (AO1)	1	The oxidising ability of the element decreases.			
17	A (AO3)	1	$\text{S}^{2-}$			
18	D (AO1)	1	Iodide ions reduce chlorine to form chloride ions.			
19	A (AO1)	1	$\text{OF}_2$			
20	B (AO1)	1	f block			
21	D (AO1)	1	$\text{OH}^-$			
22	A (AO1)	1	Magnesium oxide is a product when magnesium reacts with steam.			
23	D (AO2)	1	The lone pair electrons in liquid water molecules			