

**AQA – Atomic structure – AS Chemistry P1**

1. June/ 2020/Paper\_1/No.1

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This question is about atomic structure.

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There is a general trend for an increase in ionisation energy across Period 3.  
Give **one** example of an element that deviates from this trend.

Explain why this deviation occurs.

**[3 marks]**

Element \_\_\_\_\_

Explanation \_\_\_\_\_

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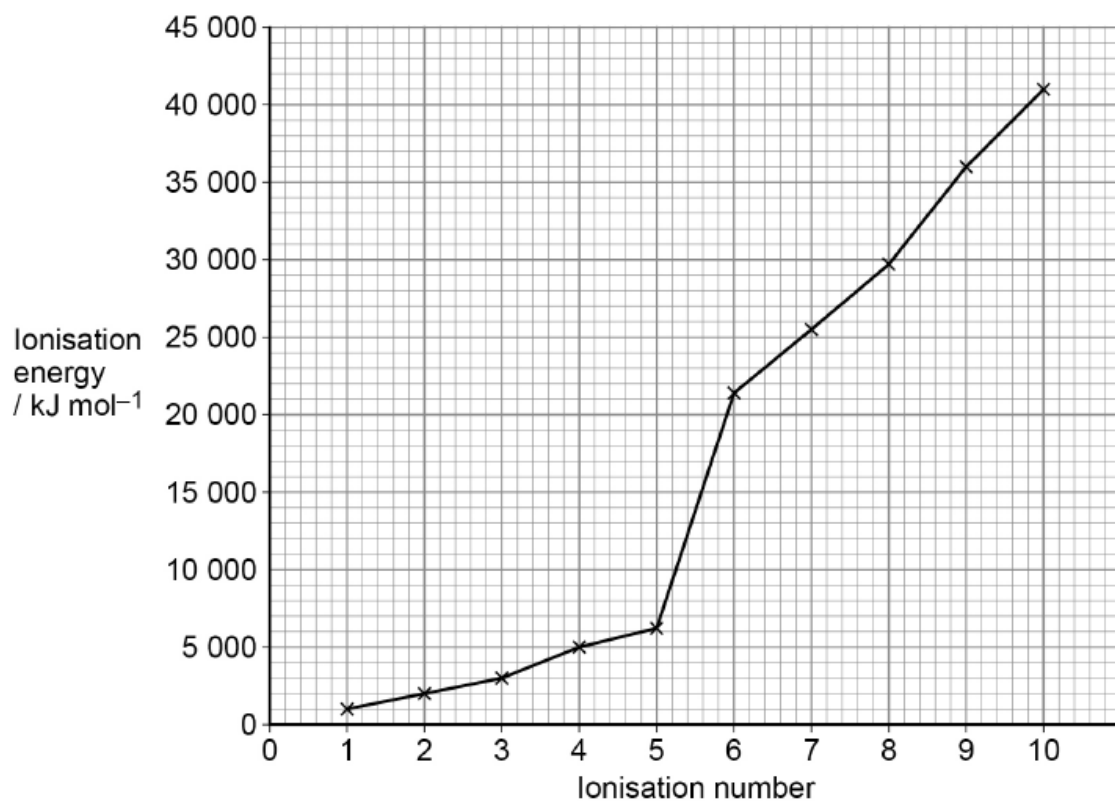
Give an equation, including state symbols, to represent the process that occurs when the **third** ionisation energy of sodium is measured.

**[1 mark]**

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0 1 . 3 Figure 1 shows the successive ionisation energies of a Period 3 element, X.

Figure 1



Identify element X.  
Explain your choice.

[3 marks]

Element \_\_\_\_\_

Explanation \_\_\_\_\_

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2. June/ 2020/Paper\_1/No.9

Which atom has the smallest number of neutrons?

[1 mark]

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

3. June/ 2020/Paper\_1/No.12

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  $\text{Li(s)} + \frac{1}{2}\text{F}_2\text{(g)} \rightarrow \text{LiF(s)}$ 

4. June/ 2020/Paper\_1/No.14

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

[1 mark]

A  $1s^2 2s^2 2p^3$ B  $1s^2 2s^2 2p^4$ C  $1s^2 2s^2 2p^6 3s^2 3p^5$ D  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^5$

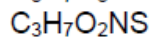
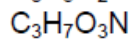
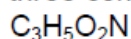
## 5. June/ 2019/Paper\_1/No.2

0 2

Time of flight (TOF) mass spectrometry is an important analytical technique.

A mixture of three compounds is analysed using a TOF mass spectrometer. The mixture is ionised using electrospray ionisation.

The three compounds are known to have the molecular formulas:



0 2 . 1

Describe how the molecules are ionised using electrospray ionisation.

**[3 marks]**

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0 2 . 2

Give the formula of the ion that reaches the detector first in the TOF mass spectrometer.

**[1 mark]**

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0 2 . 3

A sample of germanium is analysed in a TOF mass spectrometer using electron impact ionisation.

Give an equation, including state symbols, for the process that occurs during the ionisation of a germanium atom.

**[1 mark]**

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- 0 2 . 4 In the TOF mass spectrometer, a germanium ion reaches the detector in  $4.654 \times 10^{-6}$  s  
The kinetic energy of this ion is  $2.438 \times 10^{-15}$  J  
The length of the flight tube is 96.00 cm

The kinetic energy of an ion is given by the equation  $KE = \frac{1}{2}mv^2$

where

$m$  = mass / kg

$v$  = speed /  $\text{m s}^{-1}$

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

Use this information to calculate the mass, in g, of one mole of these germanium ions.  
Use your answer to state the mass number of this germanium ion.

[5 marks]

Mass of one mole of germanium ions \_\_\_\_\_ g

Mass number of ion \_\_\_\_\_

## 6. June/ 2019/Paper\_1/No.3(3.1-3.3)

0 3 This question is about chromium and its compounds.

0 3 . 1 Complete the full electron configuration of a chromium atom.

[1 mark]

$1s^2$  \_\_\_\_\_

0 3 . 2 An atom has 2 more protons and 3 more neutrons than an atom of  $^{52}\text{Cr}$ .

Deduce the symbol, including the mass number and the atomic number, for this atom.  
[1 mark]

0 3 . 3 A sample of chromium contains four isotopes and has a relative atomic mass of 52.09

**Table 2** shows the mass number and the percentage abundance of three of these isotopes.

Table 2

Mass number	52	53	54
Abundance (%)	82.8	10.9	2.7

Determine the percentage abundance of the fourth isotope.  
Show by calculation that the mass number of this isotope is 50

[3 marks]

Percentage abundance \_\_\_\_\_

Calculation







8. June/ 2019/Paper\_1/No.17

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.

9. June/ 2019/Paper\_1/No.18

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

10. June/ 2019/Paper\_1/No.19

What is the best oxidising agent?

[1 mark]

A  $F_2$

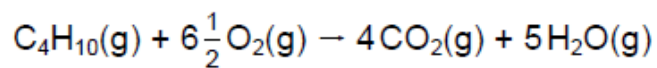
B  $F^-$

C  $I_2$

D  $I^-$

11. June/ 2019/Paper\_1/No.21

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

## 12. June/2021/Paper\_1/No.1

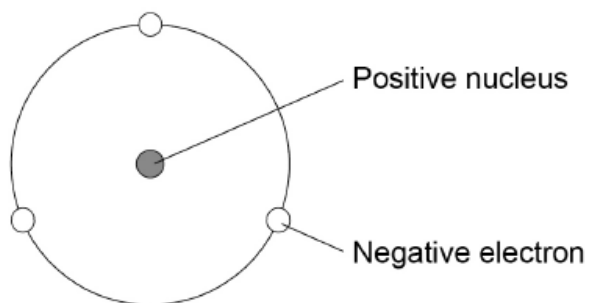
0 1

This question is about atomic structure.

0 1 . 1

Figure 1 is a model proposed by Rutherford to show the structure of an atom.

Figure 1



State two features of the current model that are not shown in the Rutherford model.

**[2 marks]**

Feature 1 of the current model \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Feature 2 of the current model \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

- 0 1 . 2 A sample of tin is analysed in a time of flight mass spectrometer. The sample is ionised by electron impact to form  $1+$  ions.

Table 1 shows data about the four peaks in this spectrum.

Table 1

m/z	Percentage abundance
112	22.41
114	11.78
117	34.97
120	To be determined

Give the symbol, including mass number, of the ion that reaches the detector first.

Calculate the relative atomic mass of tin in this sample.  
Give your answer to 1 decimal place.

[4 marks]

Symbol of ion \_\_\_\_\_

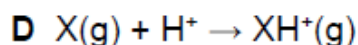
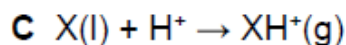
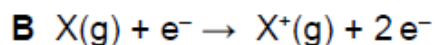
Relative atomic mass \_\_\_\_\_

**13. June/2021/Paper\_1/No.11**

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

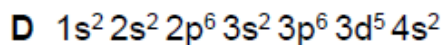
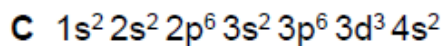
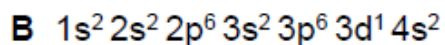
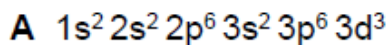
What is the equation for this ionisation?

[1 mark]

**14. June/2021/Paper\_1/No.12**

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

[1 mark]

**15. June/2021/Paper\_1/No.21**

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

[1 mark]

