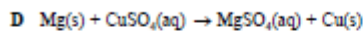
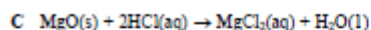
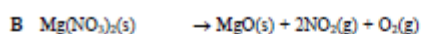
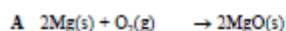


1 The equations below show some reactions of magnesium and its compounds.



(a) Which equation is **not** balanced?

(1)

☐ A

☐ B

☐ C

☐ D

(b) Which equation can be classified as a displacement reaction?

(1)

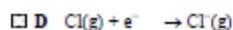
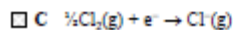
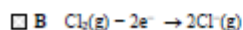
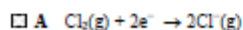
☐ A

☐ B

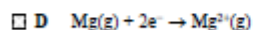
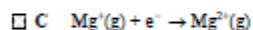
☐ C

☐ D

2 Which of these equations represents the electron affinity of chlorine?

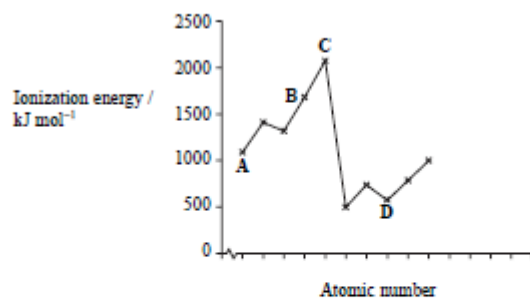


3 Which of these equations represents the second ionization of magnesium?



(Total for Question 3 = 1 mark)

4 The sketch graph below shows the trend in first ionization energies for some elements in Periods two and three.



Select, from the elements A to D, the one that

(a) has atoms with five p electrons.

(1)

☐ A

☐ B

☐ C

☐ D

(b) is a member of Group 3.

(1)

- ☐ A  
☐ B  
☐ C  
☐ D

(c) is likely to be very unreactive.

(1)

- ☐ A  
☐ B  
☐ C  
☐ D

(d) normally forms four covalent bonds per atom.

(1)

- ☐ A  
☐ B  
☐ C  
☐ D

(Total for Question 4 = 4 marks)

5 Which of these ions has the greatest ability to polarize an anion?

- ☐ A  $\text{Ba}^{2+}$   
☐ B  $\text{Ca}^{2+}$   
☐ C  $\text{Cs}^+$   
☐ D  $\text{K}^+$

(Total for Question 5 = 1 mark)

6)

The compound butane has

- ☐ A the empirical formula  $\text{C}_4\text{H}_{10}$  and the molecular formula  $\text{C}_2\text{H}_5$ .  
☐ B the empirical formula  $\text{C}_2\text{H}_5$  and the molecular formula  $\text{C}_4\text{H}_{10}$ .  
☐ C the empirical formula  $\text{C}_2\text{H}_5$  and the molecular formula  $\text{C}_n\text{H}_{2n+2}$ .  
☐ D the empirical formula  $\text{C}_n\text{H}_{2n+2}$  and the molecular formula  $\text{C}_4\text{H}_{10}$ .

1 mark)

7)

For the oxidation of ammonia



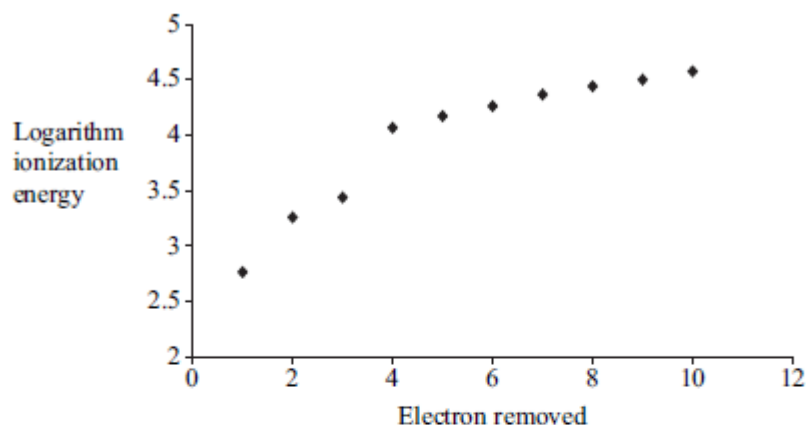
the values of the coefficients in the balanced equation are

- ☐ A  $a = 2, b = 3, c = 2$  and  $d = 3$   
☐ B  $a = 4, b = 7, c = 4$  and  $d = 4$   
☐ C  $a = 4, b = 5, c = 4$  and  $d = 6$   
☐ D  $a = 6, b = 7, c = 6$  and  $d = 9$

1 mark)

8)

The graph below represents the successive ionization energies of an element X plotted against the number of the electron removed. X is not the symbol for the element.



(a) From this graph it is possible to deduce the group in the Periodic Table to which X belongs. X is in

(1)

- ☐ A Group 1
- ☐ B Group 3
- ☐ C Group 5
- ☐ D Group 7

(b) From the graph it is possible to deduce that the most stable ion of X will be

(1)

- ☐ A  $X^{3+}$
- ☐ B  $X^+$
- ☐ C  $X^-$
- ☐ D  $X^{3-}$

2 marks)

9)

Metals usually have high melting temperatures and boiling temperatures because there are

- ☐ A strong attractions between the ions.
- ☐ B strong attractions between the delocalised electrons.
- ☐ C strong attractions between the ions and the delocalised electrons.
- ☐ D strong intermolecular forces.

1 mark)

10)

A hazard that is particularly associated with alkanes is that they are

- ☐ A corrosive.
- ☐ B flammable.
- ☐ C toxic by inhalation.
- ☐ D toxic by skin absorption.

1 mark)

11)

(a) Coral reefs are produced by living organisms and predominantly made up of calcium carbonate. It has been suggested that coral reefs will be damaged by global warming because of the increased acidity of the oceans due to higher concentrations of carbon dioxide.

(i) Write a chemical equation to show how the presence of carbon dioxide in water results in the formation of carbonic acid. State symbols are **not** required.

(1)

(ii) Write the **ionic** equation to show how acids react with carbonates. State symbols are **not** required.

(2)

12)

Most compounds of lead are insoluble, an exception being lead(II) nitrate. Therefore a good method of preparing lead(II) sulfate is

- ☐ A adding dilute sulfuric acid to lead metal.
- ☐ B adding concentrated sulfuric acid to lead metal.
- ☐ C adding dilute sulfuric acid to lead(II) nitrate solution.
- ☐ D adding dilute sulfuric acid to solid lead(II) oxide.

1 mark)

13)

Element **R** is in Group 1 of the Periodic Table and element **T** is in Group 6. **R** and **T** are not the symbols for the elements.

(a) The compound of **R** and **T** will have the formula

(1)

- ☐ A RT
- ☐ B RT<sub>6</sub>
- ☐ C RT<sub>2</sub>
- ☐ D R<sub>2</sub>T

(b) The compound of **R** and **T** will have bonding which is predominantly

(1)

- ☐ A ionic.
- ☐ B covalent.
- ☐ C dative covalent.
- ☐ D metallic.

(c) In terms of its electrical conductivity, the compound of **R** and **T** will

(1)

- ☐ A conduct when solid and liquid.
- ☐ B conduct when solid but not when liquid.
- ☐ C conduct when liquid but not when solid.
- ☐ D not conduct when solid or liquid.

3 marks)

## Section B

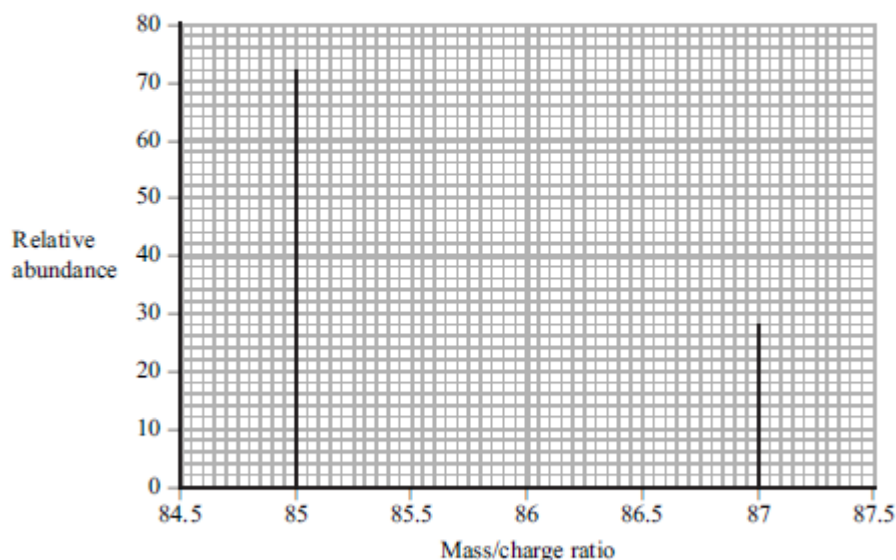
14)

The relative atomic mass of an element is determined using a mass spectrometer.

(a) Define the term **relative atomic mass**.

(2)

(b) The mass spectrum of rubidium is shown below.



(i) Explain why there are two peaks in the spectrum.

(1)

15)

This question is about the element chlorine (atomic number = 17).

(a) Complete the electronic structure of chlorine.

(1)

$1s^2 2s^2$  .....

(b) Chlorine forms compounds with magnesium and with carbon.

(i) Draw a dot and cross diagram to show the electronic structure of the compound magnesium chloride (only the outer electrons need be shown). Include the charges present.

(2)

(ii) Draw a dot and cross diagram to show the electronic structure of the compound tetrachloromethane (only the outer electrons need be shown).

(2)

\*(iii) Suggest why the melting temperature of magnesium oxide is higher than that of magnesium chloride, even though both are almost 100% ionic.

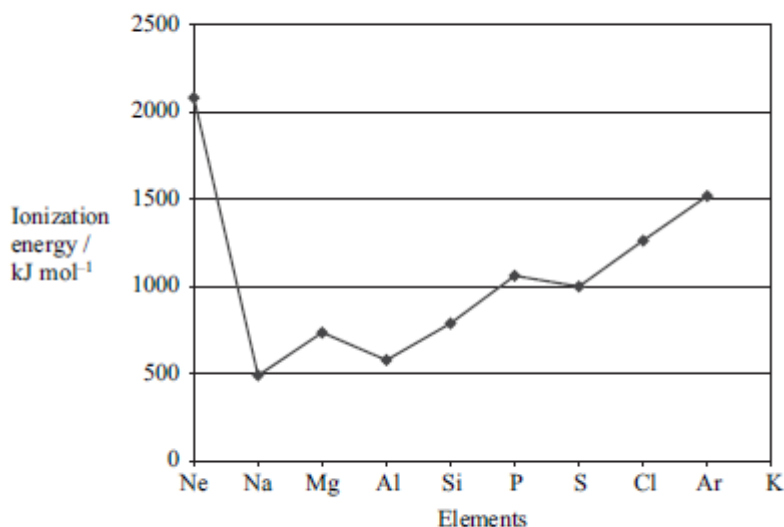
(3)

(c) Magnesium chloride may be prepared from magnesium by reaction with chlorine or with hydrochloric acid. Compare these two preparations in terms of the atom economies of the reactions. No calculation is required.

(2)

16)

- i The first ionization energy of each of the elements from neon to argon is shown on the graph below. The first ionization energy of potassium has been omitted.



- (a) Define the term **first ionization energy**. (3)
- (b) Explain why, in moving from Na to Ar, the general trend is for the first ionization energy to increase. (3)
- (c) Explain why the first ionization energy decreases from P to S. (2)
- (d) Estimate the value of the first ionization energy of potassium, K, and write your answer below. (1)

17)

Metals are good conductors of heat and electricity and usually have high melting temperatures and boiling temperatures.

- (a) (i) Describe the **structure** of a metal. (2)
- (ii) Describe the **bonding** in a metal. (2)
- (b) Explain why the melting temperature of magnesium ( $650\text{ }^{\circ}\text{C}$ ) is much higher than that of sodium ( $98\text{ }^{\circ}\text{C}$ ). (3)
- (c) Explain how metals conduct electricity. (2)

18)

The melting temperatures of the elements of Period 3 are given in the table below. Use these values to answer the questions that follow.

Element	Na	Mg	Al	Si	P (white)	S (monoclinic)	Cl	Ar
Melting temperature / K	371	922	933	1683	317	392	172	84

(a) Explain why the melting temperature of sodium is very much less than that of magnesium.

(3)

(b) Explain why the melting temperature of silicon is very much greater than that of white phosphorus.

(3)

(c) Explain why the melting temperature of argon is the lowest of all the elements of Period 3.

(1)

(d) Explain why magnesium is a good conductor of electricity whereas sulfur is a non-conductor.

(2)