

Examiners' Report
June 2014

GCE Chemistry 6CH01 01

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications come from Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk.

Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.



Giving you insight to inform next steps

ResultsPlus is Pearson's free online service giving instant and detailed analysis of your students' exam results.

- See students' scores for every exam question.
- Understand how your students' performance compares with class and national averages.
- Identify potential topics, skills and types of question where students may need to develop their learning further.

For more information on ResultsPlus, or to log in, visit www.edexcel.com/resultsplus. Your exams officer will be able to set up your ResultsPlus account in minutes via Edexcel Online.

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk.

June 2014

Publications Code US038306

All the material in this publication is copyright
© Pearson Education Ltd 2014

Introduction

The paper proved accessible to most candidates and provided them with the opportunity to demonstrate their knowledge and understanding of the key concepts in Unit 1. There was very little evidence of candidates having insufficient time to complete the paper.

The mean score for the multiple-choice questions in Section A was 14/20. Questions 1, 4 and 19 were found to be the most straightforward, whilst Questions 2, 9 and 11 were found to be the most demanding of the multiple-choice questions.

Candidates attempted the calculation questions with confidence and the free radical substitution mechanism was correctly recalled by many candidates. The questions requiring good Quality of Written Communication (e.g. Question 21(c) and Question 23(d)(iii)) were found to be the most challenging.

Question 20 (a) (i)

(a) (i) Define the term **hydrocarbon**.

(1)

A molecule containing only carbon and hydrogen atoms.



ResultsPlus
Examiner Comments

The candidate has correctly defined the term, remembering to include the word 'only'.



ResultsPlus
Examiner Tip

Learn all definitions thoroughly!

Question 20 (a) (ii)

(ii) State what is meant by the term **saturated**, as applied to a hydrocarbon.

(1)

When all of the bonds are single and the hydrocarbon cannot ~~contain~~ ^{have} any more hydrogens.



ResultsPlus
Examiner Comments

"All of the bonds are single" equates to 'ONLY single bonds' in the Mark Scheme. The second statement, pertaining to maximum number of hydrogens, is also worthy of the mark in its own right.

(ii) State what is meant by the term **saturated**, as applied to a hydrocarbon.

(1)

A single bond between the two carbons.



ResultsPlus
Examiner Comments

No mark was awarded for this response. The word ONLY was needed since in some alkene molecules, such as propene, there is a carbon-carbon double bond and a carbon-carbon single bond.



ResultsPlus
Examiner Tip

Make sure your definitions apply in all situations.

Question 20 (b) (i)

(b) Crude oil can be separated into fractions.

(i) What property allows crude oil to be separated by fractional distillation? (1)

The different boiling points of different chain lengths of hydrocarbons.



ResultsPlus
Examiner Comments

Both parts of this sentence are worthy of credit. 'Different boiling points' and 'different chain lengths' are both alternatives in the Mark Scheme.

(b) Crude oil can be separated into fractions.

(i) What property allows crude oil to be separated by fractional distillation? (1)

Has different melting and boiling points so fractions can be separated at different temperatures.



ResultsPlus
Examiner Comments

References to 'different melting points' were ignored, as mentioned in the Mark Scheme, so the mark was awarded for this response.



ResultsPlus
Examiner Tip

Try to keep answers relevant to the question set and do not include extraneous information in your responses!

Question 20 (b) (ii)

Suggest **one** reason to support this opinion.

(1)

Crude oil is non-renewable



ResultsPlus
Examiner Comments

This brief response was worthy of the mark available.



ResultsPlus
Examiner Tip

A succinct answer is often all that is required for a one-mark question!

Suggest **one** reason to support this opinion.

(1)

Biodiesel is ~~more~~ ^{made from} renewable sustainable source of fuel such as crops whereas petrol is made from crude oil which will eventually run out & is non-renewable.



ResultsPlus
Examiner Comments

References to 'sustainability' for biodiesel scored the available mark.



ResultsPlus
Examiner Tip

You should be aware of which energy sources are renewable and which are non-renewable.

Question 20 (c) (i)

Question 20 (c) (ii)

(ii) Give **one** reason why cracking reactions are carried out in industry and suggest why high temperatures are used in this process other than to speed up the reaction.

- High temperatures are used to break ^{long} ~~longer~~ chains ⁽²⁾ into smaller ones ~~in this way~~.
- The temperatures are ~~too high~~ ~~so~~ cannot
- Smaller fractions are more ~~useful~~ useful products such as diesel, petrol etc.



ResultsPlus

Examiner Comments

This answer scored both the available marks. The second scoring point in the Mark Scheme was addressed before the first scoring point. 'Break long chains...' scored the second mark in the Mark Scheme.

Reference to either smaller chains or molecules scored the first mark in the Mark Scheme.



ResultsPlus

Examiner Tip

Always check the number of marks available and structure your answer accordingly!

- (ii) Give **one** reason why cracking reactions are carried out in industry and suggest why high temperatures are used in this process other than to speed up the reaction.

(2)

Carried out in industry because high pressure and temperature is required for the process. High temperatures are used to produce a higher and better quality yield of the subproduct.



ResultsPlus
Examiner Comments

This response scored zero as neither of the marking points were correctly addressed.

Question 20 (d) (i)

(i) Explain what is meant by the term **fuel**.

A substance that can be involved in a reaction (heated) and releases energy for usage. (1)



ResultsPlus
Examiner Comments

"... releases energy..." scored the available mark.

(i) Explain what is meant by the term **fuel**.

A fuel is a substance which combusts, exothermically, and releases energy. (1)



ResultsPlus
Examiner Comments

Release of 'energy' or 'heat' had to be stated in order to secure the mark.

Question 20 (d) (ii)

- (ii) Write an equation for the **complete** combustion of butane under standard conditions. Include state symbols in your answer.

(2)



ResultsPlus
Examiner Comments

This response scored one mark out of the two available. The state symbol for butane should have been (g), rather than (l).

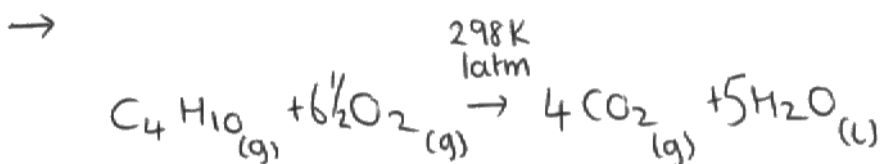


ResultsPlus
Examiner Tip

Always read the question carefully. Earlier in the question, it stated that butane "... is a gas under standard conditions." Hence the correct state symbol was (g) for butane.

- (ii) Write an equation for the **complete** combustion of butane under standard conditions. Include state symbols in your answer.

(2)



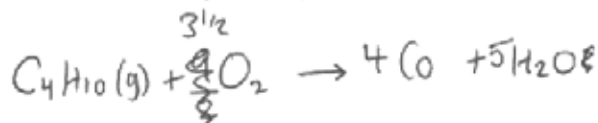
ResultsPlus
Examiner Comments

Both marks were awarded for this answer. All species were correct, as was the balancing of the equation and all four state symbols.

Question 20 (d) (iii)

(iii) Write an equation for the **incomplete** combustion of butane to form carbon monoxide and water only. State symbols are not required.

(1)



ResultsPlus
Examiner Comments

This response scored zero as the moles of oxygen were incorrect.



ResultsPlus
Examiner Tip

Always check the balancing of your equation!

(iii) Write an equation for the **incomplete** combustion of butane to form carbon monoxide and water only. State symbols are not required.

(1)



ResultsPlus
Examiner Comments

This equation scored the mark, as the species and balancing were all correct.

Question 20 (d) (iv)

(iv) Under what conditions would you expect incomplete combustion to occur?

(1)

due to an insufficient supply of oxygen



ResultsPlus
Examiner Comments

This correct answer secured the mark available.

(iv) Under what conditions would you expect incomplete combustion to occur?

(1)

Standard states of 298K in temperature
and 100KPa in pressure.



ResultsPlus
Examiner Comments

This response did not answer the question set,
so no marks were awarded.

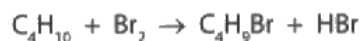


ResultsPlus
Examiner Tip

Check that the facts you are writing
answer the question set!

Question 20 (e) (i)

(e) Butane can react with bromine, in the presence of ultraviolet radiation, according to the following equation.



(i) Calculate the atom economy by mass for the formation of $\text{C}_4\text{H}_9\text{Br}$.
Use the expression

$$\text{atom economy} = \frac{\text{molar mass of the desired product}}{\text{sum of the molar masses of all products}} \times 100\%$$

Use the Periodic Table as a source of data.

$$\begin{aligned} 12 \times 4 &= 48 & 48 + 9 + 35 &= \underline{92} \leftarrow \text{C}_4\text{H}_9\text{Br} & (2) \\ 1 \times 9 &= 9 \\ \text{Br} &= 35 \end{aligned}$$

$$1 + 35 = 36 \leftarrow \text{HBr}$$

$$92 + 36 = \underline{128} \leftarrow \text{HBr and C}_4\text{H}_9\text{Br}$$

$$\frac{92}{128} \times 100 = 71.875$$

Final answer 71.9 %
~~71.88~~



ResultsPlus
Examiner Comments

Both marks were awarded. The answer was correctly rounded to three significant figures in this case. The number of significant figures required for the final answer was not specified in this question.

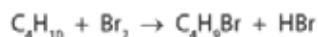


ResultsPlus
Examiner Tip

Always give your final answers to calculation questions to a suitable number of significant figures.

Question 20 (e) (ii)

*(ii) Describe the mechanism of the reaction between butane and bromine that forms the products given in the equation below.



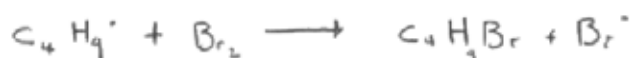
In your answer you should include

- equations for each step of the mechanism (curly arrows are **not** required)
- the name of each step occurring in the mechanism.

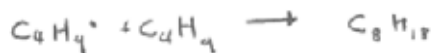
(7)



propagation



termination



ResultsPlus Examiner Comments

This answer scored six out of the seven available marks. The first mark was not awarded as the word 'initiation' did not appear anywhere in this candidate's answer.

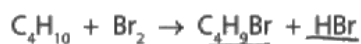
Although there was a dot missing from one of the C_4H_9 radicals, this oversight was ignored as this omission occurred at the termination stage and an incorrect termination step was not penalised.



ResultsPlus Examiner Tip

Identify every step of the mechanism, when asked to do so!

*(ii) Describe the mechanism of the reaction between butane and bromine that forms the products given in the equation below.

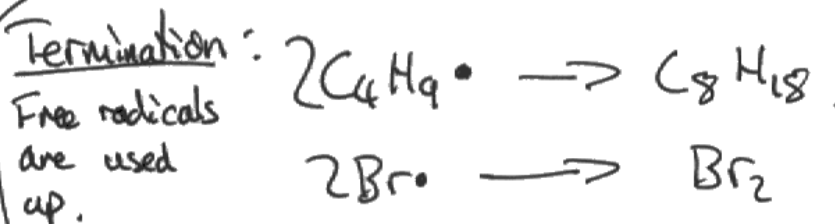
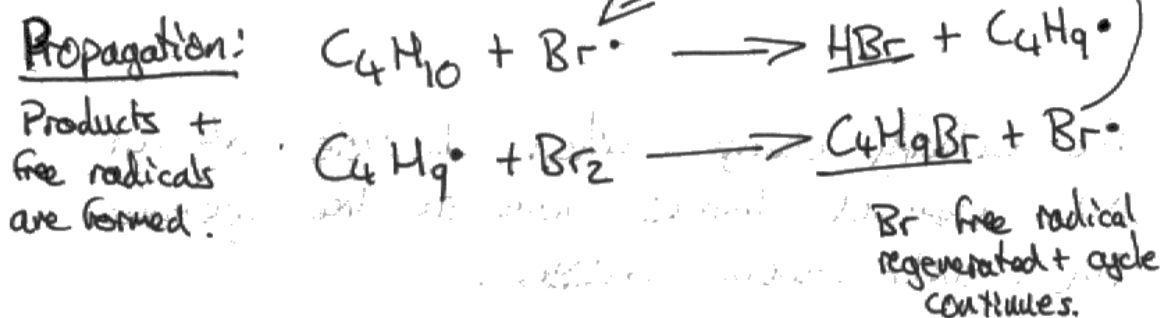
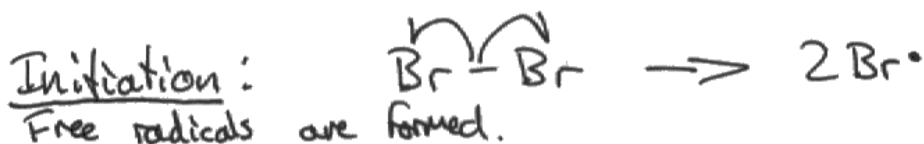


In your answer you should include

- equations for each step of the mechanism (curly arrows are **not** required)
- the name of each step occurring in the mechanism.

(7)

Free radical substitution



ResultsPlus
Examiner Comments

This response scored full marks as all seven marking points were correctly addressed.

Question 21 (a)

(a) Define the term **lattice energy**.

(2)

The energy required produced when a cation
an an anion join together forming an ionic
compound.



ResultsPlus
Examiner Comments

No first mark was awarded, as there was no reference to '1 mol' of an ionic compound. The second scoring point was not awarded, as there was no reference to 'gaseous ions'.



ResultsPlus
Examiner Tip

Learn all definitions thoroughly!

(a) Define the term **lattice energy**.

(2)

The enthalpy change when one mole
of ionic substance is formed from its
gaseous ^{constituents} ~~substituents~~ elements under
standard conditions.



ResultsPlus
Examiner Comments

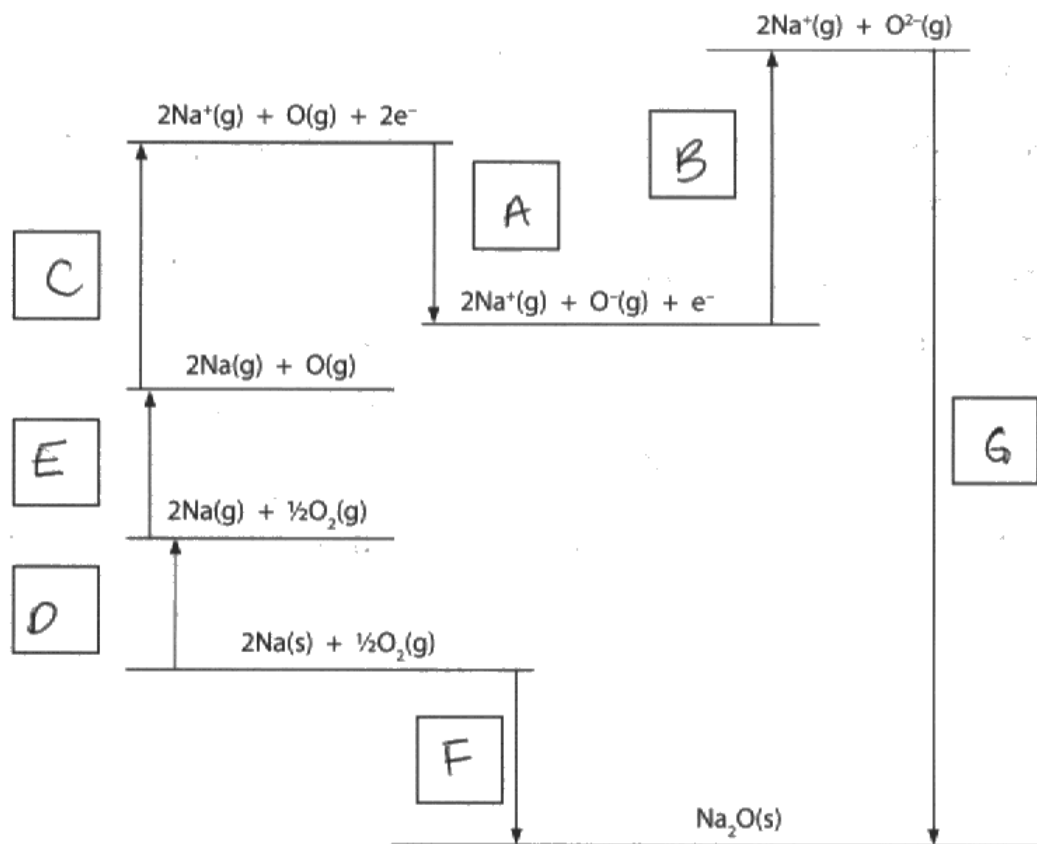
Only the first mark was awarded. The second mark was not awarded as 'gaseous ions' were not mentioned.

Note: 'From gaseous elements' is in the Reject column of the Mark Scheme.

Question 21 (b) (i)

(b) (i) Write the correct letters from the table of data to label the Born-Haber cycle below.

(3)

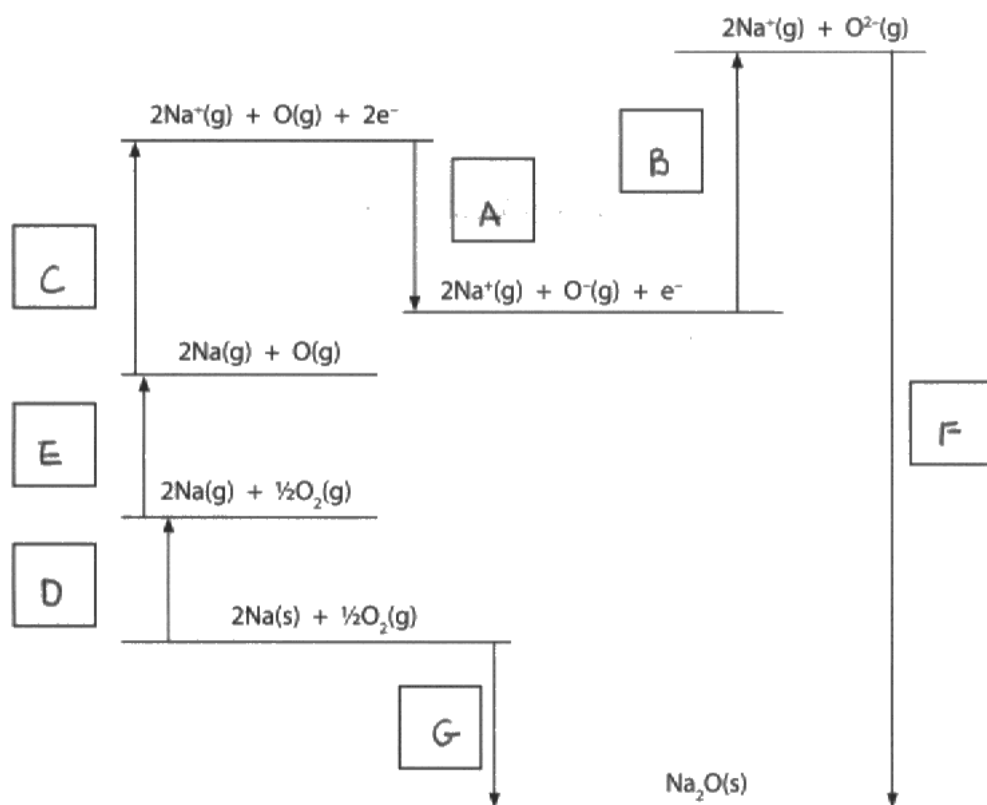


ResultsPlus
Examiner Comments

All letters are correct, so all three marks were awarded.

(b) (i) Write the correct letters from the table of data to label the Born-Haber cycle below.

(3)



ResultsPlus
Examiner Comments

This response scored two out of the three available marks. Letters F and G are the wrong way round. So five letters overall are correct and, as stated in the Mark Scheme, two marks are awarded.



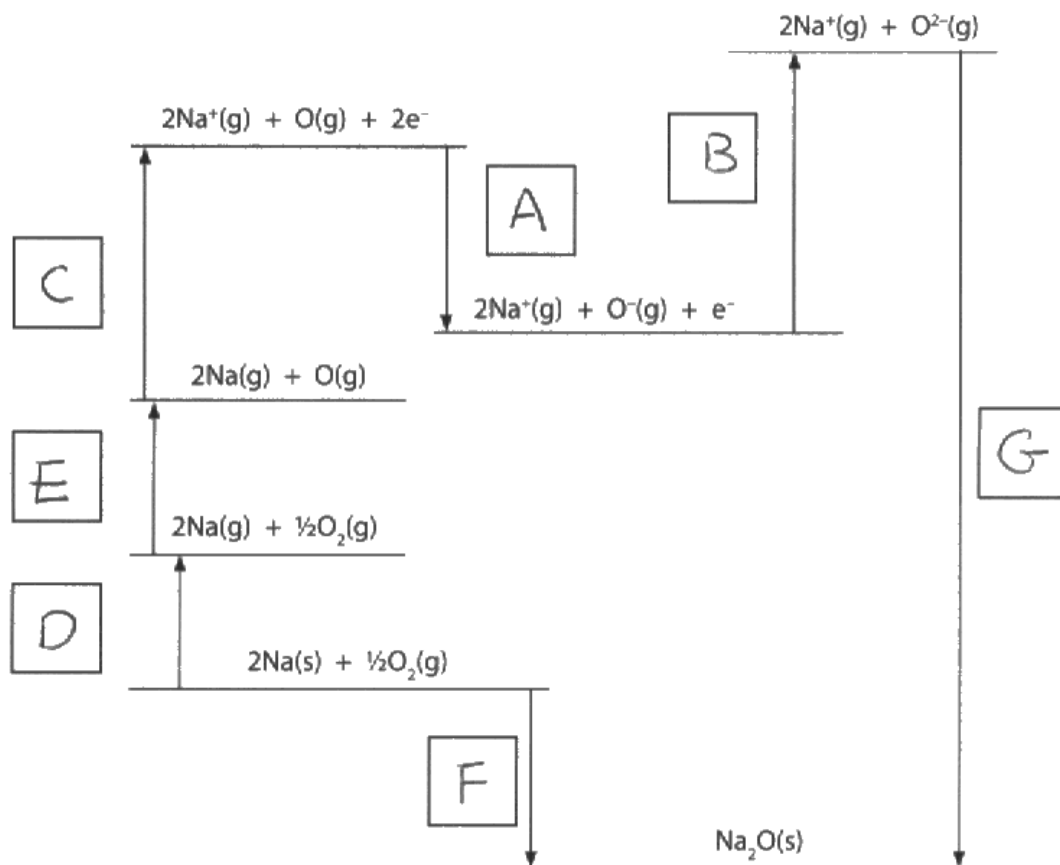
ResultsPlus
Examiner Tip

Learn all the enthalpy changes required to construct a Born-Haber cycle.

Question 21 (b) (ii)

(b) (i) Write the correct letters from the table of data to label the Born-Haber cycle below.

(3)



(ii) Calculate the lattice energy of sodium oxide, enthalpy change **G**, in kJ mol^{-1} .

(2)

$$\begin{aligned}
 G &= -B - A - C - E - D + F \\
 &= (-790) - (141) - (496) - (249) - (108) + (-414) \\
 &= -1916 \text{ kJ mol}^{-1}
 \end{aligned}$$



ResultsPlus
Examiner Comments

As per the Mark Scheme, $-1916 \text{ kJ mol}^{-1}$ scored one out of two marks. The candidate has not doubled 108 (the enthalpy change of atomization of sodium) and has also not doubled 496 (the first ionization energy of sodium) when using the data for sodium oxide, Na_2O .

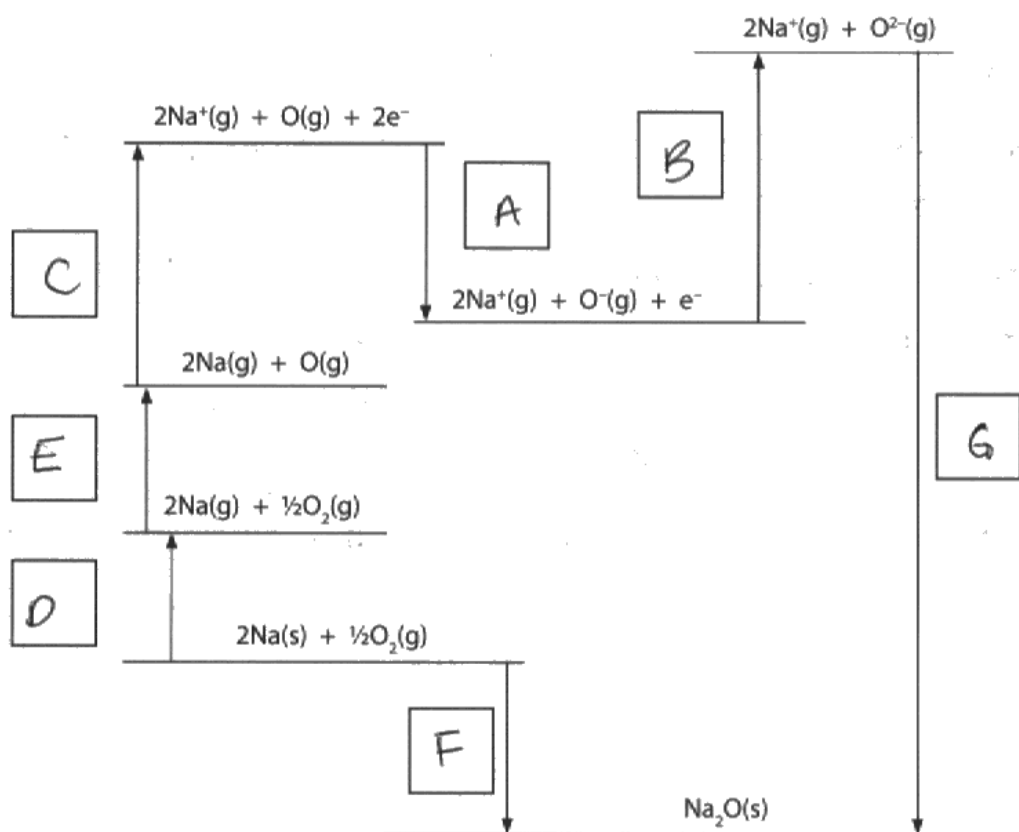


ResultsPlus
Examiner Tip

Practise constructing Born-Haber cycles for binary ionic compounds with different stoichiometries.

(b) (i) Write the correct letters from the table of data to label the Born-Haber cycle below.

(3)



(ii) Calculate the lattice energy of sodium oxide, enthalpy change **G**, in kJ mol^{-1} .

(2)

$$\begin{aligned}
 G &= -B - A - 2C - E - 2D + F \\
 &= -790 + 141 - (2 \times 496) - 249 - (2 \times 108) - 414 \\
 &= -2802 = 2661 = 2520
 \end{aligned}$$



ResultsPlus
Examiner Comments

This response scored both available marks. Although the final answer on the answer line was not written very clearly, the value of $-2520 \text{ kJ mol}^{-1}$ is written above the final answer (along with the working), confirming that this is the candidate's final answer.



ResultsPlus
Examiner Tip

If you wish to amend an answer, it is better to cross out your original answer and re-write your new answer rather than try to amend the digits.

Question 21 (c)

*(c) Predict whether the lattice energy of magnesium oxide, MgO, is more or less exothermic than the lattice energy of magnesium sulfide, MgS.

Justify your answer in terms of the sizes and the charges of the ions involved.

(4)

MgO lattice energy is more exothermic as ~~oxide ions have even though~~ both oxide and sulphide ions have the same charge, oxide ions have a smaller radius so there is less shielding and a closer distance to the nucleus. ~~and electrons~~ subsequently there is a stronger attraction of electrons to the nucleus so ^{more energy is} they are required to remove them.



ResultsPlus Examiner Comments

This response scored three out of the four available marks - namely, the first three scoring points in the Mark Scheme.

The fourth mark was not awarded as there was no mention of the relative strength of attraction between the cations and anions (attraction of the nucleus to electrons has been quoted instead, which is not relevant to the required answer).



ResultsPlus Examiner Tip

Make sure that you understand the exact nature of the electrostatic attractions when discussing different types of bonding.

*c) Predict whether the lattice energy of magnesium oxide, MgO, is more or less exothermic than the lattice energy of magnesium sulfide, MgS.

Justify your answer in terms of the sizes and the charges of the ions involved.

(4)

Magnesium sulfide will ~~not~~ be more exothermic because the sulfide anion is larger so will be more polarised by the Mg^{2+} cation. Therefore more energy will be given out when the lattice is formed. The charges on the Mg^{2+} cations ~~and~~ are equal and so are the sulfide and oxide anions so this will not affect the lattice energy. MgS has a lower charge density than MgO.



ResultsPlus
Examiner Comments

This response scored two out of the four marks. The first scoring point was not awarded, as magnesium oxide is more exothermic than magnesium sulfide. The second scoring point was awarded for "...because the sulfide anion is larger..." The third scoring point was awarded as the candidate implied that the charges on the sulfide and oxide anions are the same. The fourth scoring point was not awarded, as no comparison was made between the strength of attraction between Mg^{2+} and O^{2-} ions with that between Mg^{2+} and S^{2-} ions.



ResultsPlus
Examiner Tip

Do not confuse discussion of the factors affecting the magnitude of the lattice energies of different compounds with comparisons between theoretical and experimental lattice energy values for the same compound!

Question 22 (a)

Question 22 (b)

Isotope	Percentage abundance
^{58}Ni	69.02
^{60}Ni	27.32
^{62}Ni	3.66

Calculate the relative atomic mass of nickel. Give your answer to **two** decimal places.

$$\left(\frac{69.02}{100} \times 58\right) + \left(\frac{27.32}{100} \times 60\right) + \left(\frac{3.66}{100} \times 62\right) \quad (2)$$
$$= 58.69$$



ResultsPlus
Examiner Comments

Both marks were awarded for this correct response.



ResultsPlus
Examiner Tip

Make sure you know the difference between decimal places and significant figures!

Isotope	Percentage abundance
⁵⁸ Ni	69.02
⁶⁰ Ni	27.32
⁶² Ni	3.66

Calculate the relative atomic mass of nickel. Give your answer to **two** decimal places.

(2)

$$69.02 + 27.32 + 3.66$$

$$= 100$$

$$100 \div 3 = 33.3$$

$$58 + 60 + 62 = 180$$

$$180 \div 3 = 60$$

Relative atomic mass of nickel
 = 60



ResultsPlus
 Examiner Comments

This incorrect response scored no marks.



ResultsPlus
 Examiner Tip

Practise calculations involving relative atomic mass determination, given the percentage abundance of each isotope.

Question 22 (c)

(c) Nickel reacts with carbon monoxide, CO, to give the compound nickel carbonyl, Ni(CO)₄.



- (i) Calculate the volume of carbon monoxide, in dm³, measured at room temperature and pressure, that is required to react completely with 5.87 g of nickel.

[Relative atomic mass: Ni = 58.7

Molar volume of a gas = 24 dm³ mol⁻¹ at room temperature and pressure.]

(3)

mol × MW

$$\text{Ni } \frac{5.87}{58.7} = 0.1 \quad 1:4$$

$$4\text{CO} = 0.1 \times 4 = 0.4$$

Volume of CO = $0.4 \times 24 = \underline{\underline{9.6 \text{ dm}^3}}$

- (ii) Calculate the number of carbon monoxide molecules present in the volume of gas you have calculated in (c)(i).

[The Avogadro constant, $L = 6.02 \times 10^{23} \text{ mol}^{-1}$]

(1)

mols × AC

$$0.4 \times 6.02 \times 10^{23}$$

$$= \underline{\underline{2.408 \times 10^{23}}}$$

$$= \underline{\underline{1.204 \times 10^{23}}}$$



ResultsPlus
Examiner Comments

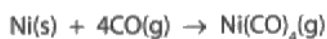
There is a fully correct answer for (c)(i), so three out of three marks were awarded here. No mark was awarded for (c)(ii), as the correct answer has been halved.



ResultsPlus
Examiner Tip

In questions such as those in (c)(ii), make sure you check whether the number of atoms or the number of molecules has to be calculated.

- (c) Nickel reacts with carbon monoxide, CO, to give the compound nickel carbonyl, Ni(CO)₄.



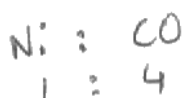
- (i) Calculate the volume of carbon monoxide, in dm³, measured at room temperature and pressure, that is required to react completely with 5.87 g of nickel.

[Relative atomic mass: Ni = 58.7

Molar volume of a gas = 24 dm³ mol⁻¹ at room temperature and pressure.]

(3)

$$\text{(Ni) moles} = \frac{5.87}{58.7} = 0.1 \text{ moles.}$$



$$0.1 \times 4 = 0.4$$

$$0.4 = \frac{v}{24} = 9.6 \text{ dm}^3$$

- (ii) Calculate the number of carbon monoxide molecules present in the volume of gas you have calculated in (c)(i).

[The Avogadro constant, $L = 6.02 \times 10^{23} \text{ mol}^{-1}$]

(1)

$$\begin{aligned} 0.4 \times 6.02 \times 10^{23} \\ = 2.41 \times 10^{23} \end{aligned}$$



ResultsPlus Examiner Comments

Both (c)(i) and (c)(ii) have been answered correctly. Note how 2.408×10^{23} has been correctly rounded to 2.41×10^{23} (i.e. three significant figures) in the final answer to (c)(ii).



ResultsPlus Examiner Tip

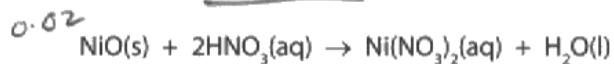
In calculations, always give your final answer to a sensible number of significant figures!

Question 22 (d) (i)

(d) Nickel(II) nitrate, $\text{Ni}(\text{NO}_3)_2$, can be made by several different methods.

Method 1

Nickel(II) oxide, NiO , was reacted with dilute nitric acid according to the equation



- (i) Calculate the volume of 2.00 mol dm^{-3} dilute nitric acid, in cm^3 , that was required to exactly neutralize 1.494 g of nickel(II) oxide.

Use the relative atomic masses: $\text{Ni} = 58.7$, $\text{O} = 16.0$

(3)

$$\frac{1.494}{(58.7 + 16)} = 0.02$$

Mol of nitric acid =

$$\frac{\text{Vol}}{\text{Mol} \times 1 \text{ dm}^3} = \frac{\text{Mol}}{\text{Conc} \times \text{Vol}}$$

1:2
 $\text{NiO} : 2\text{HNO}_3$
 $0.02 : 0.04 \text{ Mol}$

$$\text{Vol} = \frac{0.04}{2} \times 1000 = 20 \text{ cm}^3$$

~~Vol = 40 cm³~~



ResultsPlus Examiner Comments

Two marks out of a maximum of three marks were awarded for this answer. The first two scoring points were achieved, but not the third, as the volume of dilute nitric acid required should have been 20 cm^3 , not 40 cm^3 .



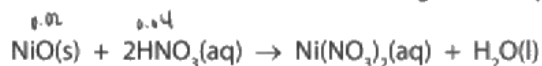
ResultsPlus Examiner Tip

Check all calculations thoroughly!

(d) Nickel(II) nitrate, $\text{Ni}(\text{NO}_3)_2$, can be made by several different methods.

Method 1

Nickel(II) oxide, NiO, was reacted with dilute nitric acid according to the equation



- (i) Calculate the volume of 2.00 mol dm^{-3} dilute nitric acid, in cm^3 , that was required to exactly neutralize 1.494 g of nickel(II) oxide.

Use the relative atomic masses: Ni = 58.7, O = 16.0

$$\text{No. of moles of NiO} = \frac{1.494}{58.7 + 16} = 0.02$$

$$\text{Vol. of dil. HNO}_3 \text{ needed} = \frac{0.02 \times 2}{2} = \underline{0.02 \text{ dm}^3}$$

$$\frac{\text{moles}}{\text{dm}^3} = M$$
$$\text{dm}^3 = \frac{\text{moles}}{M}$$

(3)



ResultsPlus
Examiner Comments

This answer scored all three marks as a correct answer in units of dm^3 was also acceptable.



ResultsPlus
Examiner Tip

Check the units required for your final answer. These are often, but not always, stated in the question.

Question 22 (d) (ii)

Method 2

A volume of 25.0 cm^3 of 2.00 mol dm^{-3} nitric acid, HNO_3 , was transferred to a beaker. Solid nickel(II) carbonate, NiCO_3 , was added until it was in excess.

(ii) Why was **excess** nickel(II) carbonate used?

(1)

to make sure all the acid had reacted



ResultsPlus
Examiner Comments

This correct answer scored the mark available.



ResultsPlus
Examiner Tip

Knowing which reagent is in excess makes this question straightforward!

Question 22 (d) (iii)

(iii) Why must the beaker be **much** larger than the volume of acid used?

(1)

The acid ~~to~~ could fizz over, so if it is much larger then the acid ~~wont~~ won't spill over.



ResultsPlus
Examiner Comments

The production of carbon dioxide gas in this reaction, with the resultant fizzing, is the reason that the beaker must be much larger than the volume of acid used.



ResultsPlus
Examiner Tip

When carrying out an experiment, always make sure that you understand the method.

(iii) Why must the beaker be **much** larger than the volume of acid used?

(1)

The beaker must be much larger to avoid losing any of the solution.

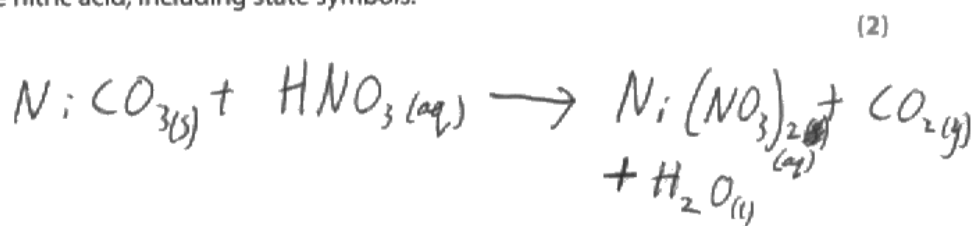


ResultsPlus
Examiner Comments

As there was no reference to fizzing (or equivalent), no mark was awarded for this response.

Question 22 (d) (iv)

(iv) Write a balanced equation for the reaction between nickel(II) carbonate and dilute nitric acid, including state symbols.



ResultsPlus
Examiner Comments

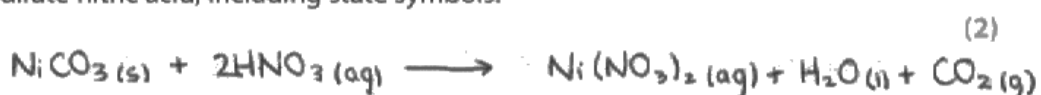
This response scored the first mark, as all the species are correct. The second mark was not awarded as, although all five state symbols were correct, the equation has not been balanced (2HNO₃ required).



ResultsPlus
Examiner Tip

Check balancing when writing equations!

(iv) Write a balanced equation for the reaction between nickel(II) carbonate and dilute nitric acid, including state symbols.



ResultsPlus
Examiner Comments

Both marks were awarded for this fully correct response.



ResultsPlus
Examiner Tip

Don't forget to give state symbols in equations when they are required.

Question 22 (d) (v)

*(v) For **Method 2**, describe the practical steps that you would take to obtain pure dry crystals of hydrated nickel(II) nitrate, $\text{Ni}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$, from a mixture of nickel(II) nitrate solution and unreacted solid nickel(II) carbonate.

(4)

filter to remove the excess nickel(II) carbonate. then heat to remove excess water (until crystals have begun to form around edge). then leave to cool in a cooling cupboard. then clean crystals with a small volume of cold distilled water and then filter again.



ResultsPlus
Examiner Comments

This answer scored three out of the four possible marks. The first three marks were awarded. The fourth scoring point was not awarded as there is no mention of drying the crystals.



ResultsPlus
Examiner Tip

Be familiar with all the stages carried out during the preparation of salt crystals.

*(v) For **Method 2**, describe the practical steps that you would take to obtain pure dry crystals of hydrated nickel(II) nitrate, $\text{Ni}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$, from a mixture of nickel(II) nitrate solution and unreacted solid nickel(II) carbonate.

1. Following the ^{reaction} ~~reaction~~, filter the ~~solution~~ ^{unreacted} through a funnel and filter paper to remove ~~unreacted~~ solids. (4)
2. Heat the solution to remove excess water, stopping when crystals begin to form.
3. Leave the solution to fully crystallise.
4. Remove the crystals and dry them off with absorbant tissue paper.



ResultsPlus
Examiner Comments

This is an excellent answer, addressing all four scoring points. So maximum credit was earned.



ResultsPlus
Examiner Tip

Set out your answers clearly, in a logical way!

Question 23 (a)

Question 23 (b)

(b) An atom of potassium has mass number 39. Explain why argon is placed before potassium in the modern Periodic Table.

(1)

Potassium has a larger atomic number than Argon.



ResultsPlus
Examiner Comments

A concise, correct response, so the mark available was awarded.



ResultsPlus
Examiner Tip

Be aware that elements are arranged in the Periodic Table in order of increasing atomic number.

(b) An atom of potassium has mass number 39. Explain why argon is placed before potassium in the modern Periodic Table.

(1)

Argon is a noble gas therefore it's under group 0.
Also the atomic number for potassium is 19
so and argon is 18, so potassium comes after
argon as ^{the periodic} ~~that's how~~ the table is according to
atomic numbers



ResultsPlus
Examiner Comments

Quoting the correct atomic numbers for argon and potassium earned the mark.

Question 23 (c)

(c) In the context of the Periodic Table, explain what is meant by the term **periodicity**.

(2)

The arrangement of elements ~~over~~ in order of ~~increasing~~ increasing atomic number across periods.



ResultsPlus

Examiner Comments

Neither scoring point was addressed, so no marks were awarded here.



ResultsPlus

Examiner Tip

Make sure that you answer the question set!

(c) In the context of the Periodic Table, explain what is meant by the term **periodicity**.

(2)

a ~~repeating pattern~~ pattern that slowly increases and repeats itself. ~~for example in the periodic table~~



ResultsPlus

Examiner Comments

Both the available marks were awarded here. For the first mark, there is a mention of a "pattern" and, for the second mark, the idea that the pattern "...repeats (itself)".

Question 23 (d) (i)

- (i) Name **one** of the elements above that is composed of **simple molecules** at room temperature and pressure.

(1)

~~As~~ ~~S~~ Chlorine



ResultsPlus
Examiner Comments

Chlorine exists as diatomic molecules, Cl_2 .



ResultsPlus
Examiner Tip

Be aware, too, that phosphorus exists as molecules, P_4 , as does sulfur, S_8 .

Question 23 (d) (ii)

(ii) Silicon has a giant atomic structure. Explain how this structure results in the high melting temperature shown on the graph.

(2)

There are many strong covalent bonds between the Si atoms as silicon exists as a giant covalent lattice. These bonds ~~require~~ are hard to break so require a lot of energy to break so the melting point is very high.



ResultsPlus
Examiner Comments

This response scores two marks, as both scoring points have been addressed.



ResultsPlus
Examiner Tip

Always relate melting temperature to the amount of heat energy needed to overcome the interactions (e.g. bonds) between the particles.

(ii) Silicon has a giant atomic structure. Explain how this structure results in the high melting temperature shown on the graph.

(2)

Since silicon has a giant structure, lots of energy is needed to break the bonds in order to melt it thus why the melting temperature is highest at 1400°C



ResultsPlus
Examiner Comments

This response scored one out of two marks. The first mark was not awarded as there is no mention of 'strong' bonds. The second mark was awarded as the requirement that "lots of energy is needed to break the bonds ..." has been included in the answer.

Question 23 (d) (iii)

(iii) Explain why the melting temperature of magnesium is higher than that of sodium.

(3)

The melting temperature of magnesium is higher than that of sodium because sodium can only form 1 bond but magnesium can form 2 bonds. The more covalent bonds there are, the stronger these bonds are. Therefore it takes more energy to break the bonds because the attraction felt between the 2 positive electrostatic nuclei and the shared electrons is higher, so the melting point is higher.



ResultsPlus
Examiner Comments

This answer scores no marks. The third scoring point mark was not awarded as the nature of the electrostatic attractions in a metal have been described incorrectly.



ResultsPlus
Examiner Tip

Make sure that you fully understand the nature of the electrostatic attractions present in metallic bonding.

(iii) Explain why the melting temperature of magnesium is higher than that of sodium.

(3)

Na has a +1 charge whereas Mg has a +2 charge, therefore in magnesium the attraction between the positive ion and the delocalised electrons are stronger, as magnesium has more delocalised electrons.



ResultsPlus
Examiner Comments

This answer scored two out of the three available marks. The 'charge' mark was not awarded, as there is no reference to magnesium ions (or Mg^{2+}) having a higher charge than sodium ions (or Na^+). A mark was awarded for the statement that "magnesium has more delocalised electrons". The final scoring point was addressed, as the stronger attraction between magnesium ions and the delocalised electrons has been acknowledged.

Paper Summary

On the basis of their performance on this paper, candidates are offered the following advice.

- Make sure that your writing is legible
- Use the amount of space provided for each answer, along with the mark allocation, as a guide to how much detail is required in your response
- Make sure you understand what you are being asked to do before you start to answer the question
- Make sure you understand clearly the difference between an ATOM, a MOLECULE and an ION
- As well as learning practical techniques, think about the reason for each step of the procedure and why it works.

Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:

<http://www.edexcel.com/iwantto/Pages/grade-boundaries.aspx>

Ofqual



Llywodraeth Cynulliad Cymru
Welsh Assembly Government



Pearson Education Limited. Registered company number 872828
with its registered office at Edinburgh Gate, Harlow, Essex CM20 2JE