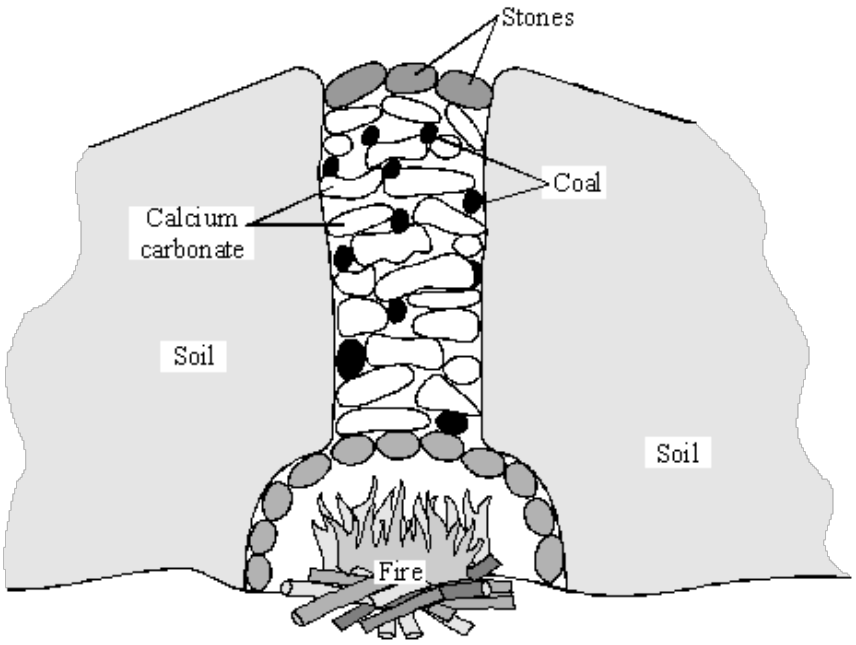
Q1. An old lime kiln made in the ground is shown.



(a) The *thermal decomposition* of calcium carbonate makes a white solid and carbon dioxide.

(i) Name a naturally occurring form of calcium carbonate.

.....

.....

(1)

(ii) What does *thermal decomposition* mean?

.....

.....

(2)

(iii) Suggest and explain the purpose of the coal.

.....

.....

.....

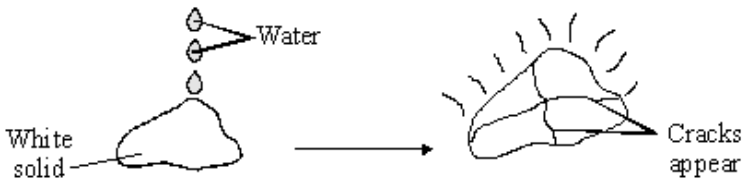
(2)

(iv) Write a word equation for the thermal decomposition of calcium carbonate.

..... → ..... + ...

(2)

(b) The diagrams show what happens when drops of cold water are added to the white solid formed by heating calcium carbonate.



(ii) What type of chemical reaction takes place?

.....

(1)

(ii) Give the chemical name of the solid formed. Give a use of this solid.

Name .....

Use .....

(2)

(Total 10 marks)

Q2. Bags of readi-to-mix concrete contain three ingredients.

Readi-to-mix Concrete

contains
cement
crushed rock
sand

Complete each sentence by choosing the correct words from the box.

clay	**limestone**	**salt**	**slaked lime**	**water**

Cement is made by heating..... and ..... in a rotary kiln.

To make concrete, the contents of the bag of readi-to-mix concrete must be mixed with

..... .

(Total 3 marks)

Q3. Limestone contains calcium carbonate.

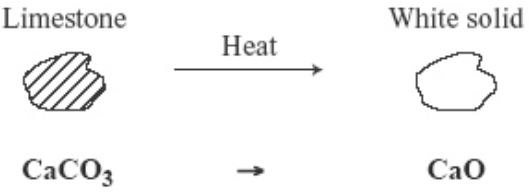
(a) Calcium carbonate has the formula $CaCO_3$.

Complete the sentence by writing in the correct numbers.

The formula of calcium carbonate is made up of 1 calcium atom, ... carbon atom(s) and ..... oxygen atom(s).

(2)

(b) When limestone is heated it forms two other compounds.



(i) State **one** safety precaution that you should take when heating limestone.

.....

(1)

(ii) Name the white solid produced.

.....

(1)

(iii) Why does a piece of limestone lose mass as it is heated?

.....

.....

(1)

(d) A company wants to quarry limestone. There are some houses near the quarry.

Residents in the houses say that they do not want a quarry next to them.

(i) Suggest **two** reasons why they do not want the quarry next to them.

1 .....

.....

2 .....

.....

(2)

(ii) Suggest **one** possible benefit to the residents of having a quarry near their houses.

.....

.....

(1)

(Total 8 marks)

Q4. Limestone has been called the Earth's most useful rock.

(a) Limestone contains calcium carbonate, $CaCO_3$.

(i) Complete the table to show the number of atoms of each element in the formula of calcium carbonate.

Calcium has been done for you.

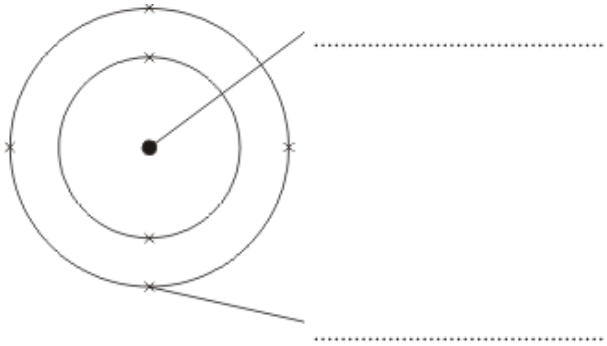
Element	**Number of atoms in the formula $CaCO_3$**
Calcium, Ca	1
Carbon, C	
Oxygen, O	

(2)

(ii) The diagram below represents a carbon atom.

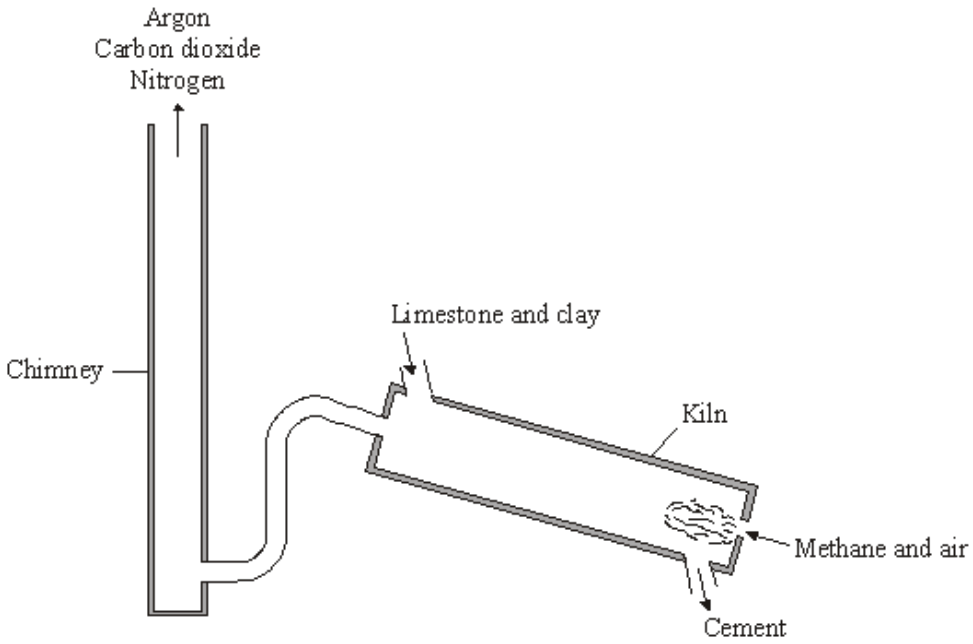
Use words from the box to label the parts of this atom.

bond	**electron**	**molecule**	**nucleus**



(2)

(b) At a cement works, limestone is mixed with clay and heated in a kiln.



Use the information in the diagram to answer these questions.

(i) Name the fuel that is used to heat the limestone and clay.

.....

(1)

(ii) Limestone contains calcium carbonate, $CaCO_3$.

Draw a ring around the correct gas in the box to complete the sentence.

The gas formed when calcium carbonate decomposes is	argon. carbon dioxide. nitrogen.

(1)

(c) The cement works starts to burn a different fuel.

Local residents are concerned because more children are suffering asthma attacks. Residents have also noticed that parked cars are becoming dirty because of smoke particles from the chimney.

The table shows the possible medical risk from smoke particles.

Particle size in mm	Medical effect
Larger than 0.4	No medical risks known
0.3 and smaller	Causes asthma attacks
0.2 and smaller	May cause cancer

(i) Give **two** reasons why local residents are concerned about the cement works burning a different fuel.

1 .....

.....

2 .....

.....

(2)

(ii) The company operating the cement works stated that smoke particles from the chimney had not changed since it started burning the different fuel.

If you were a local resident, what evidence would you like to see to help you decide if the company's statement is true or not?

.....

.....

.....

.....

(2)

(Total 10 marks)

Q5. Limestone and the products of limestone have many uses.

(a) Limestone is quarried.

Photograph © Lonny Kalfus / Getty Images

Quarrying limestone has impacts that cause environmental problems.

Tick (✓) **two** impacts that cause environmental problems.

Impact of quarrying	Tick (✓)
Puts off tourists	
Causes dust pollution	
Increases jobs	
Increases traffic	

(2)

(b) Limestone contains calcium carbonate, $CaCO_3$. When it is heated calcium carbonate produces calcium oxide and carbon dioxide.

The word equation for this reaction is:

calcium carbonate → calcium oxide + carbon dioxide

(i) Complete the sentence.

The reaction when calcium carbonate is heated is called

thermal .....

(1)

(ii) 100 g of calcium carbonate was heated and produced 56 g of calcium oxide. Calculate the mass of carbon dioxide produced.

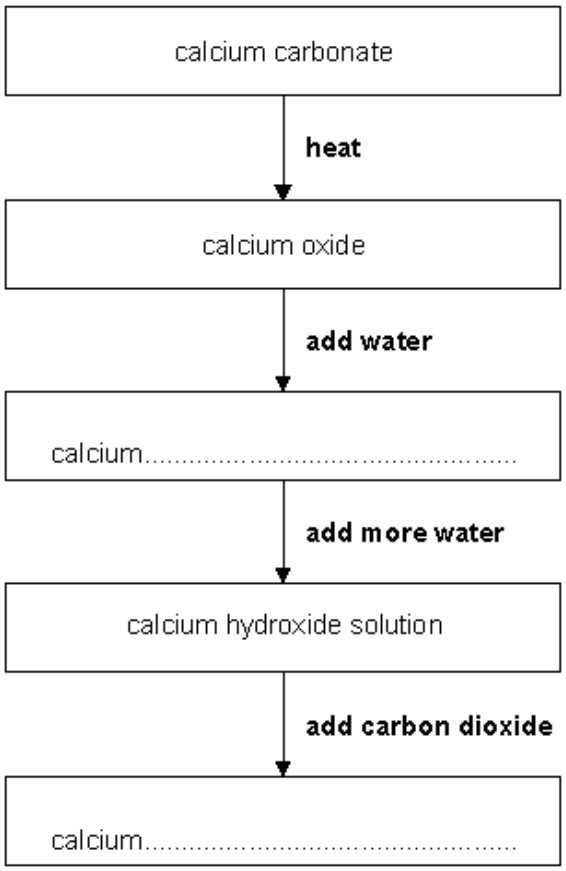
.....

..... g

(1)

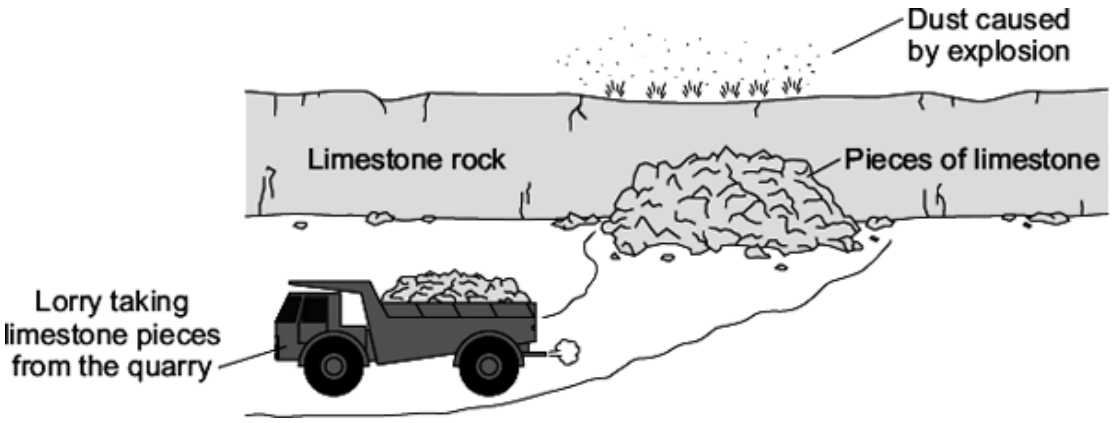
(c) The flow chart shows the stages in the limestone cycle.

Complete the names of the calcium compounds formed in the flow chart.



(2)
(Total 6 marks)

Q6. In a quarry, limestone is blasted into pieces by explosives.
The pieces of limestone are taken from the quarry by lorries.



(a) Draw a ring around the correct word in the box to complete the sentence.

Limestone can be used as a | building / plastic / smart | material.

(1)

(b) Tick (✓) **one** possible advantage for people who live near to the limestone quarry.

Advantage	Tick (✓)
causes more traffic	
provides jobs	
attracts tourists to the area	

(1)

(c) Give **two** types of pollution that would be caused by the limestone quarry.

1 .....

2 .....

(2)

(d) Limestone contains calcium carbonate ($CaCO_3$).

Complete the **two** empty boxes in the table about the formula of calcium carbonate.

Name of element	Symbol for the element	Number of atoms in the formula
calcium	Ca	1
carbon	C	1
oxygen	.....	.....

(2)

(e) Lorries take some of the limestone to be heated in a lime-kiln.
Calcium carbonate, in the limestone, decomposes when heated.

Use the balanced chemical equation to help you complete the word equation for the decomposition of calcium carbonate.

$CaCO_3$ → CaO + CO_2

calcium carbonate → ..... + carbon dioxide

(1)
(Total 7 marks)

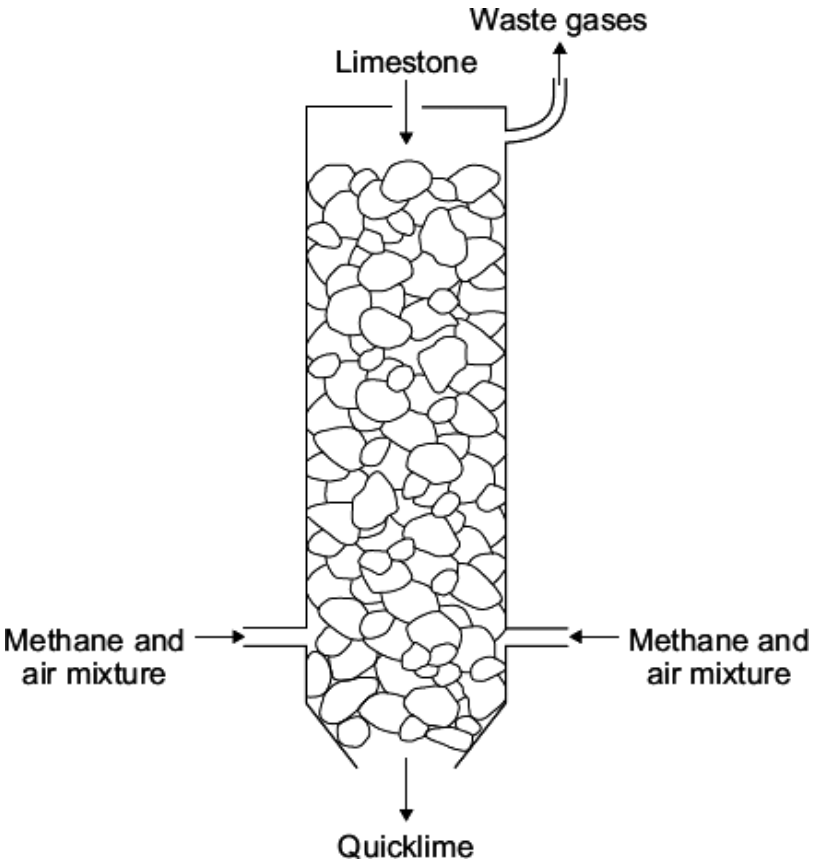
Q7. Limestone is mainly calcium carbonate, $CaCO_3$

(a) Complete the **two** empty boxes in the table.

Symbol	Element	Number of atoms in the formula $CaCO_3$
Ca	calcium	1
C	carbon	.....
O	oxygen	.....

(2)

(b) The diagram shows a lime kiln.
A lime kiln is used to heat limestone to make quicklime.



Use the diagram to help you to answer these questions.

(i) Draw a line from each substance to the name of the main chemical(s) that the substance contains.

Substance	Name of the main chemical(s)
air	nitrogen and oxygen
quicklime	calcium oxide
waste gases	nitrogen and carbon dioxide
	calcium carbonate
	methane

(3)

(ii) A mixture of methane and air is used in the lime kiln.

Explain why.

.....

.....

.....

.....

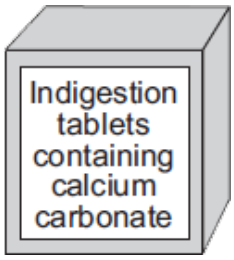
(2)

(c) Tick (✓) **two** uses of limestone.

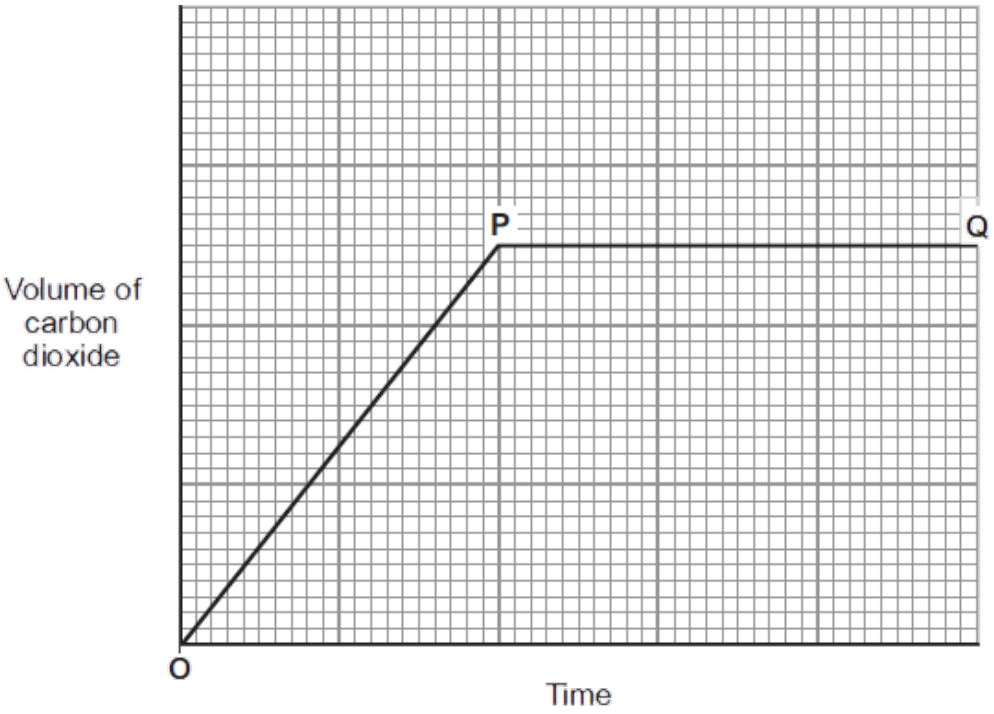
Use of limestone	Tick (✓)
as a building material	
to make poly(ethene)	
as a fuel	
to make cement	

(2)
(Total 9 marks)

Q8. Human stomachs contain hydrochloric acid.
Stomach ache can be caused by too much acid in the stomach.
Indigestion tablets can be used to reduce the amount of acid in the stomach.



(a) The graph shows how the volume of carbon dioxide produced changes with time, after some calcium carbonate is added to hydrochloric acid.



(i) Complete the sentence to explain what happens between **O** and **P**.

Between **O** and **P** the calcium carbonate and hydrochloric acid .....

(1)

(ii) Complete the sentence to explain what happens at **P**.

At **P** the calcium carbonate and hydrochloric acid .....

because .....

(2)

(iii) Describe the test for carbon dioxide gas.

Test .....

Result of the test .....

(2)

(b) Calcium carbonate is found in limestone.
Limestone is removed from the ground by quarrying.

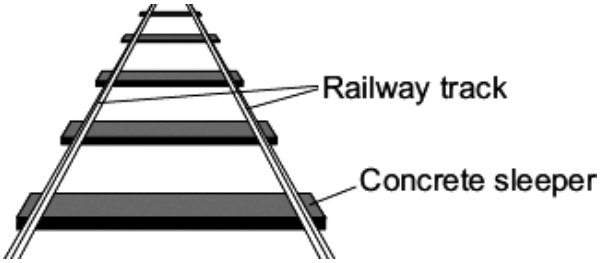
Photograph supplied by Stockbyte/Thinkstock

Tick (✓) **one** advantage and tick (✓) **one** disadvantage of quarrying limestone.

Statement	Advantage Tick (✓)	Disadvantage Tick (✓)
Quarrying limestone destroys the shells and skeletons of marine organisms that formed the limestone.		
Quarrying limestone releases dust, and lorries release carbon dioxide from burning diesel fuel.		
Quarrying limestone provides building materials, employment and new road links.		
Quarrying limestone removes ores from the ground.		

(2)
(Total 7 marks)

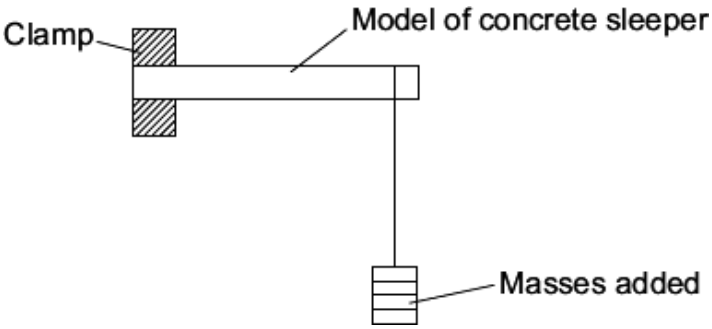
Q9. In the UK, railway sleepers are often made from concrete.



A scientist was asked to find the best concrete mixture to use so that railway sleepers would not break easily.

The scientist made:

- a mould to make small models of concrete sleepers
- concrete mixtures using crushed rock, sand, cement and water
- the equipment shown to add 0.1 kg masses until the model sleeper broke.



The scientist's results are shown in the table.

Concrete mixture in % by volume			**Total mass added to break the model sleeper in kg**			
Cement	**Sand**	**Crushed rock**	**Test 1**	**Test 2**	**Test 3**	**Mean**
10	70	20	1.1	1.3	1.2	1.2
20	60	20	2.6	2.5	2.4	
30	50	20	3.3	3.3	3.3	3.3
40	40	20	3.8	4.0	3.3	3.9
50	30	20	4.5	4.2	4.3	4.3

(a) (i) Calculate the mean total mass added to break the model sleeper that has 20% cement by volume.

.....

Mean = ... kg

(1)

(ii) Choose **one** result in the table that the scientist should check and test again.

Result: % cement by volume ..... Test number .....

Explain why you chose this result.

.....

.....

(2)

(iii) What is the relationship between the total mass to break the model sleeper and the percentage (%) of cement by volume in the concrete mixture?

.....

.....

(1)

(iv) Suggest **one** other variable that the scientist should have recorded in the table of results.

.....

(1)

(b) The scientist thought that full-size railway sleepers should be made from 30% cement, 50% sand and 20% crushed rock.

What other information about these three materials is needed before the scientist recommends using this mixture to make a full-size railway sleeper?

.....

.....

.....

.....

(2)
(Total 7 marks)

Q10. Cement is made by heating a mixture of clay and limestone in a kiln.

(a) Many kilns are heated by burning natural gas (methane) in air.

A chemical equation for the burning of methane is:

$$CH_4 + 2O_2 \rightarrow 2H_2O + CO_2$$

Describe this reaction in words.

Give the names of the molecules **and** the numbers of each molecule in this chemical equation.

.....

.....

.....

.....

(2)

(b) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Limestone contains calcium carbonate.
There is a large deposit of limestone under an area of natural beauty.
A company wants to quarry this limestone and build a kiln near to the quarry to make cement.

Area of natural beauty

Evelyn Simak [CC-BY-SA-2.0], via Wikimedia Commons

A quarry

By Thomas Bjørkan (Own work) [CC-BY-SA-3.0], via Wikimedia Commons

Explosives will be used to extract the limestone out of the ground.
Heavy machinery will be used to lift and crush the limestone.
Lorries will be used to transport the limestone to the kiln to make cement.
The lorries and the heavy machinery will use diesel fuel.

Quarrying limestone and making cement will have an impact on everything near the area.

Describe the positive and the negative impacts of quarrying limestone and making cement.

.....

.....

.....

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.....

.....

.....

(6)
(Total 8 marks)

Q11. Carbon dioxide is produced when metal carbonates are heated.

(a) (i) Draw a ring around the correct answer to complete the word equation.

magnesium carbonate ⟶ [magnesium / magnesium hydroxide / magnesium oxide] + carbon dioxide

(1)

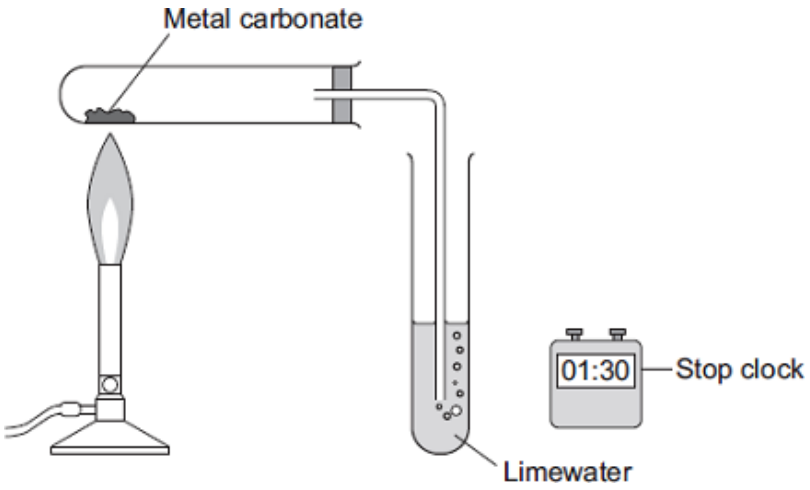
(ii) Draw a ring around the correct answer to complete the sentence.

The reaction to produce carbon dioxide from magnesium carbonate is

combustion.
decomposition.
fermentation.

(1)

(b) A student investigated what happens when metal carbonates are heated.



The student:

- used the apparatus to investigate heating four metal carbonates
- started the stop clock at the same time as he began to heat the metal carbonate
- stopped the stop clock when carbon dioxide was produced.

The student's results are shown in the table.

Metal carbonate	**Time taken for the production of carbon dioxide to start in seconds**
Calcium carbonate	163
Copper carbonate	24
Magnesium carbonate	92
Zinc carbonate	67

(i) Tick (✓) the type of graph the student should draw from these results.

Type of graph	**Tick (✓)**
Bar chart	
Line graph	
Scatter graph	

(1)

(ii) Use the Chemistry Data Sheet to help you to answer this question.

Draw a ring around the correct answer to complete the sentence.

The more reactive the metal in the carbonate the | less / more / same | time is taken for the

production of carbon dioxide to start.

(1)

(iii) How did the student know that carbon dioxide was produced?

Use the diagram of the apparatus to help you to answer this question.

.....

.....

.....

.....

(2)
(Total 6 marks)