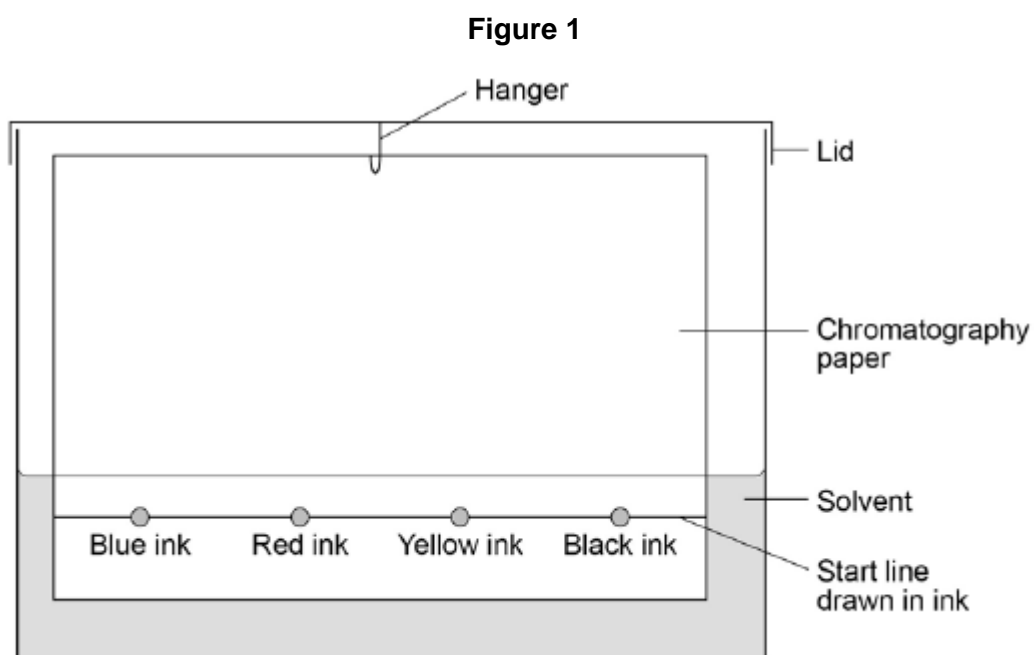# New Document 1

Time: **37 minutes**

Marks: **36 marks**

Comments:

Q1.

A student used paper chromatography to investigate the colours in different inks.

Figure 1 shows the apparatus the student used.

Figure 1

(a)   The student made **two** mistakes in setting up the apparatus.

Identify the **two** mistakes.

Describe the problem each mistake would cause.
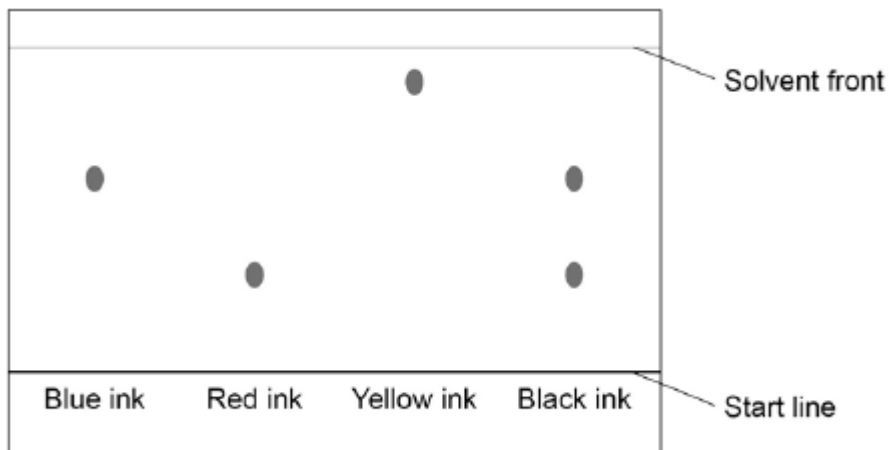
Mistake 1 _____

Problem   _____

_____

_____

Mistake 2 _____

Problem   _____

_____

_____

(4)

(b)   The student then set up the apparatus without making any mistakes.

Figure 2 shows his results.

Figure 2

Blue ink   Red ink   Yellow ink   Black ink

Solvent front

Start line

What colours are in the black ink?

_____

_____

(1)

(c)   Which of the inks is the most soluble in the solvent?

Give a reason for your answer.

Ink   _____

Reason   _____

_____

(2)

(d)   Use **Figure 2** to complete the table below, then calculate the Rf value for red ink.

	Distance in mm
Distance moved by red ink	_____
Distance from start line to solvent front	_____

The R_f value for red ink is calculated using the equation.

$R_f = \dfrac{\text{distance moved by red ink from the start line}}{\text{distance moved by solvent from the start line}}$

Give your answer to two significant figures.

_____

_____

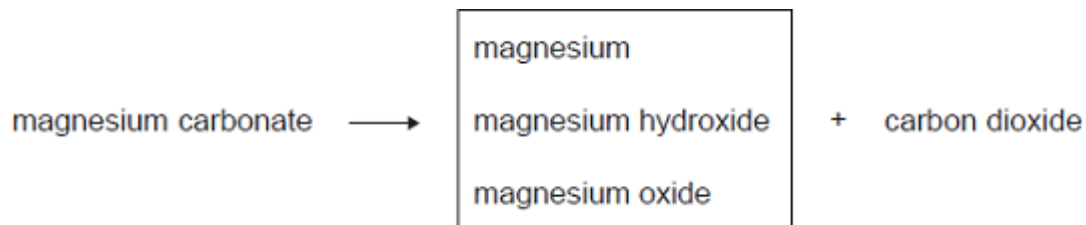R$_f$ value = _____

(5)

(e)   How can you tell from **Figure 2** that the R_f value for the blue ink is greater than the Rf value for the red ink?

_____

_____

(1)
(Total 13 marks)

Q2.

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   +   carbon dioxide
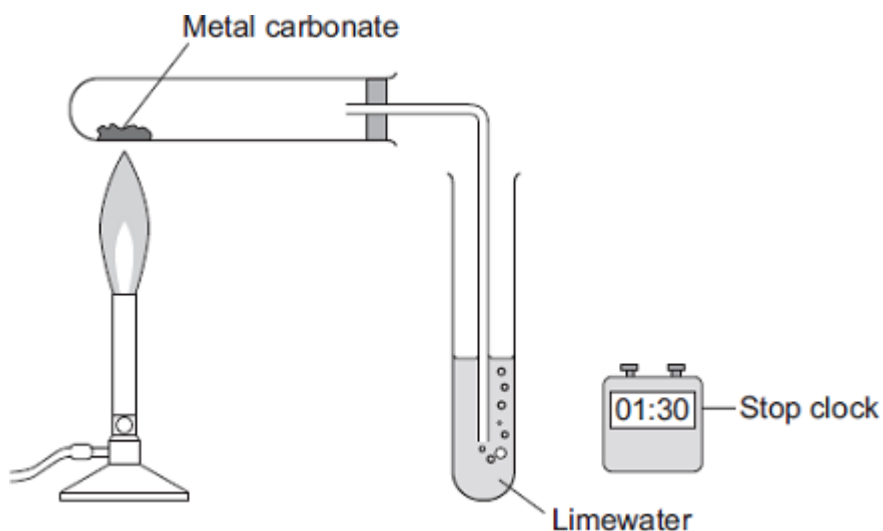| magnesium oxide

(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.

Metal carbonate

01:30 — Stop clock

Limewater

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 | time is |
| same |

taken for the production of carbon dioxide to start.

(1)

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

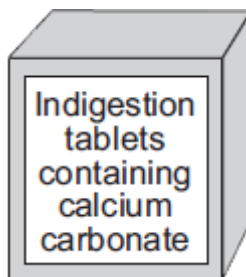Use the diagram of the apparatus to help you to answer this question.

_____

_____

_____

_____

(2)
(Total 6 marks)

Q3.

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.

Indigestion tablets containing calcium carbonate

(a)   The graph shows how the volume of carbon dioxide produced changes with time, after some calcium carbonate is added to hydrochloric acid.
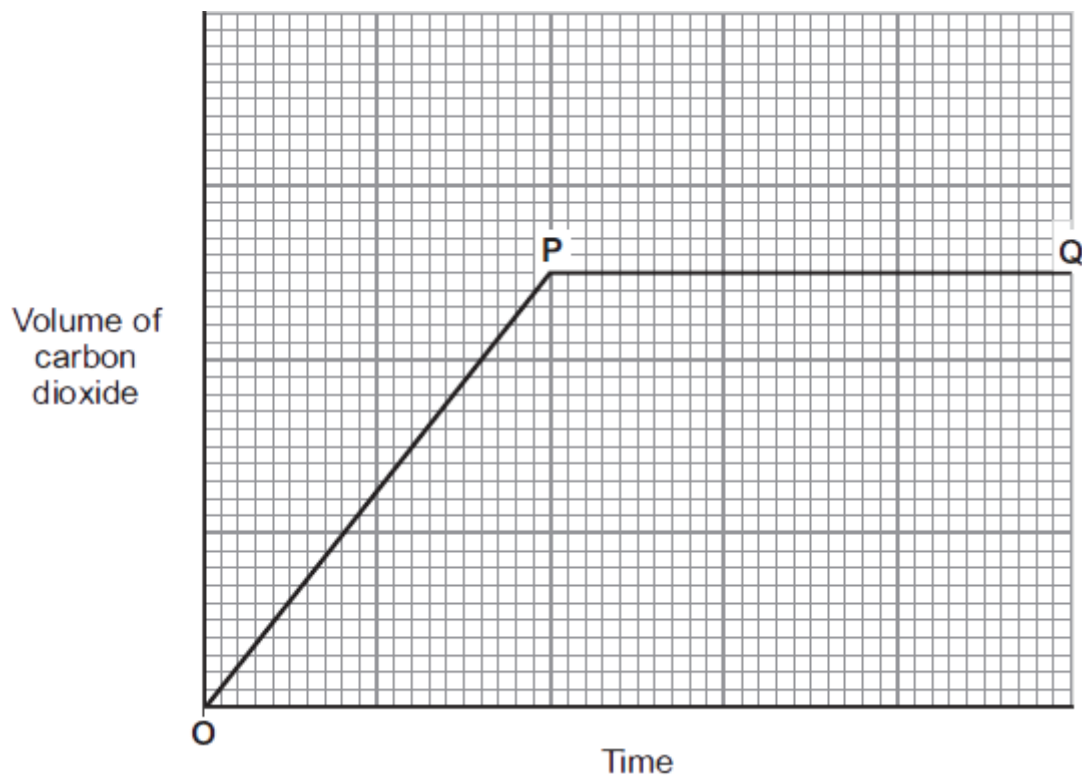
(i)   Complete the sentence to explain what happens between **O** and **P**.

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)

Q4.

The apparatus in the figure below is used to separate a mixture of liquids in a fuel.
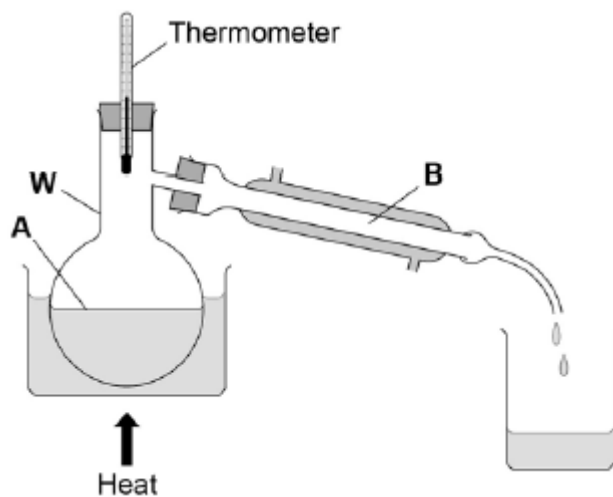
(a) What is apparatus **W** on above the figure above?

Tick **one** box.

Beaker ☐

Boiling Tube ☐

Flask ☐

Jug ☐

(1)

(b) What is the name of this method of separation?

Tick **one** box.

Crystallisation ☐

Electrolysis ☐

Filtration ☐

Distillation ☐

(1)

(c) Name the changes of state taking place at **A** and **B** in the figure above.

Use words from the box.

boiling	condensing	freezing	melting

Change of state at **A**: _____

Change of state at **B**: _____

(2)

(d)   **Table 1** shows the boiling points of the hydrocarbons in the fuel.

Table 1

Hydrocarbon	Boiling point in °C
Pentane	36
Hexane	69
Heptane	98
Octane	125

Which hydrocarbon will be the last to collect in the beaker?

Tick **one** box.

Pentane ☐

Hexane ☐

Heptane ☐

Octane ☐

(1)

(e)   The fuel is a mixture of liquids that has been designed as a useful product.

What name is given to this type of mixture?

Tick **one** box.

Catalyst ☐

Formulation ☐

Polymer ☐

Solvent ☐

(1)

(f)   Describe how this fuel is different from crude oil.

_____

_____

_____

_____

(2)

(g)   A student measured the melting point of a solid hydrocarbon four times.

The student's results are in **Table 2**.

Table 2

	Trial 1	**Trial 2**	**Trial 3**	**Trial 4**
Melting point in °C	35	48	37	37

Calculate the mean melting point of the hydrocarbon, leaving out any anomalous result.

Give your answer to two significant figures.

_____

_____

Mean melting point = _____ °C

(2)

(Total 10 marks)

Mark schemes

Q1.

(a)   start line drawn in ink

1

(so) line would run

1

start line below solvent level

1

(so) samples would wash off

1

(b)   red **and** blue

both colours needed

1

(c)   yellow

1

travels furthest up the paper

1

(d)   distance moved by red ink 13 ±1

*measurements in cm max **1** mark for mps 1 and 2*

1

distance from start line to solvent front 44 ±1

1

correct substitution

1

allow ecf from Table 4

correct answer

1

range if correct is 0.27 to 0.33

to 2 significant figures

1

(e)   moves further **or** nearer the top of the paper

1

[13]

Q2.

(a)   (i)   magnesium oxide

1

(ii)   decomposition

1

(b)   (i)   bar chart

1

(ii)   more

1

(iii) limewater

1

turns cloudy / milky
accept forms a white precipitate

1

[6]

Q3.

(a) (i) react
allow neutralise
allow bubbles / fizzes
accept produces gas / CO_2F
ignore rises

1

(ii) stop <u>reacting</u> / <u>producing</u>
stops on its own is insufficient allow stop working / bubbling / fizzing

1

the (hydrochloric) acid / (calcium) carbonate is used up
accept because the (calcium) carbonate has neutralised the (hydrochloric) acid

OR

have been used up (1)

the <u>graph line</u> becomes horizontal / levels out (1)

OR

stays the same / no change (1)
ignore reference to graph line

no further reaction (1)

1

(iii) bubble the gas through limewater / calcium hydroxide solution
allow (add) limewater
test must be correct to gain result mark

1

(the solution) goes cloudy
allow milky

1

(b) advantage > Quarrying limestone provides building materials, employment and new road links

1

disadvantage > Quarrying limestone releases dust, and lorries release carbon dioxide from burning diesel fuel

1

[7]

Q4.

(a)   Flask

1

(b)   Fractional distillation

1

(c)   **A** – boiling
                    in this order

1

      B – condensing

1

(d)   Pentane

1

(e)   Formulation

1

(f)   the fuel is a pure compound

1

and crude oil is a mixture

or

the fuel is made up of four hydrocarbons
          allow crude oil contains a large number of compounds and
          the fuel contains four

and crude oil could have many more

1

(g)   (35 + 37 + 37 / 3) = 36.33

1

36

1

          *allow (35 + 48 + 37 + 37 / 4 =) 39(.25) for **1** mark*

[10]