AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE
COMBINED SCIENCE: TRILOGY

H

Higher Tier
Chemistry Paper 2H

Time allowed: 1 hour 15 minutes

Materials

For this paper you must have:
- a ruler
- a scientific calculator
- the periodic table (enclosed).

Instructions
- Use black ink or black ball-point pen.
- Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
TOTAL	

Information
- The maximum mark for this paper is 70.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

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IB/M/Jun22/E11

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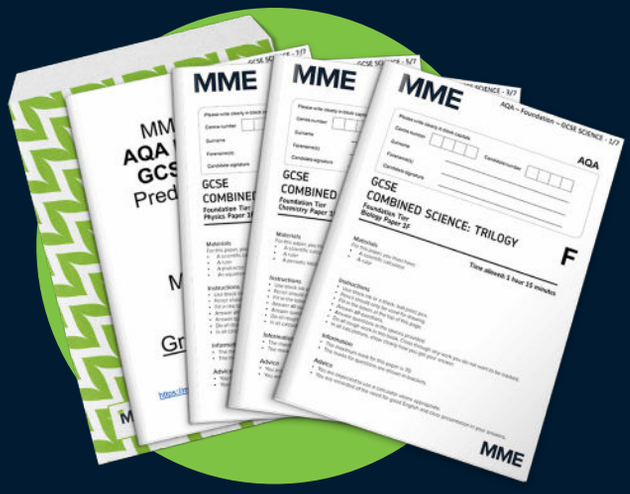
MME. Revision Products - GCSE Science



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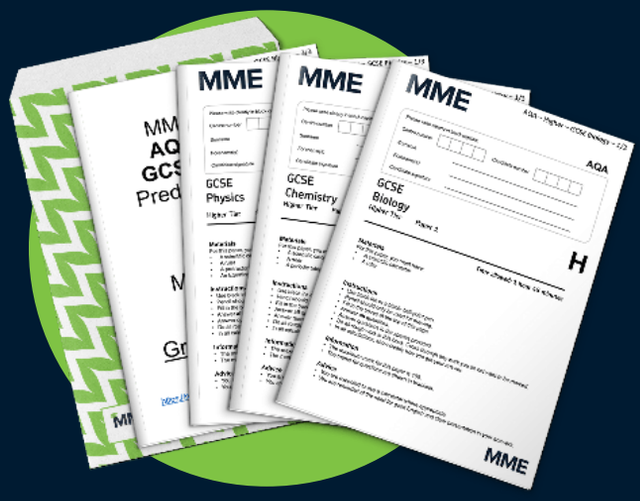
Predicted Papers 2024



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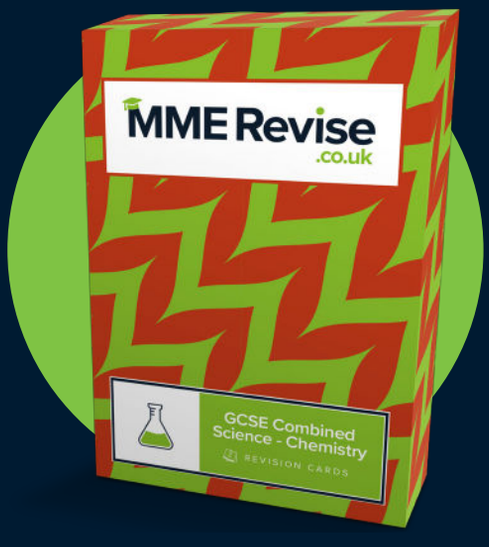

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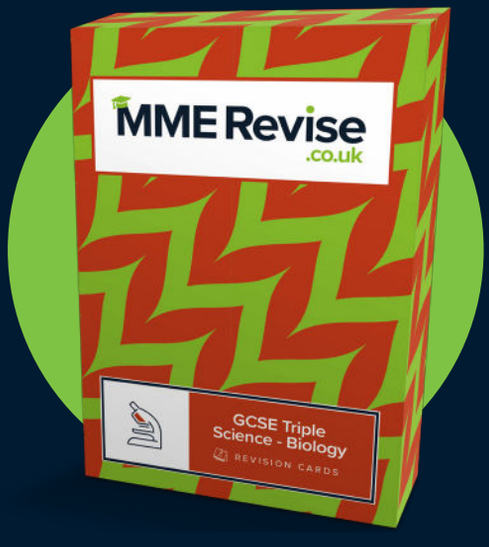

GCSE Triple Science
Revision Cards

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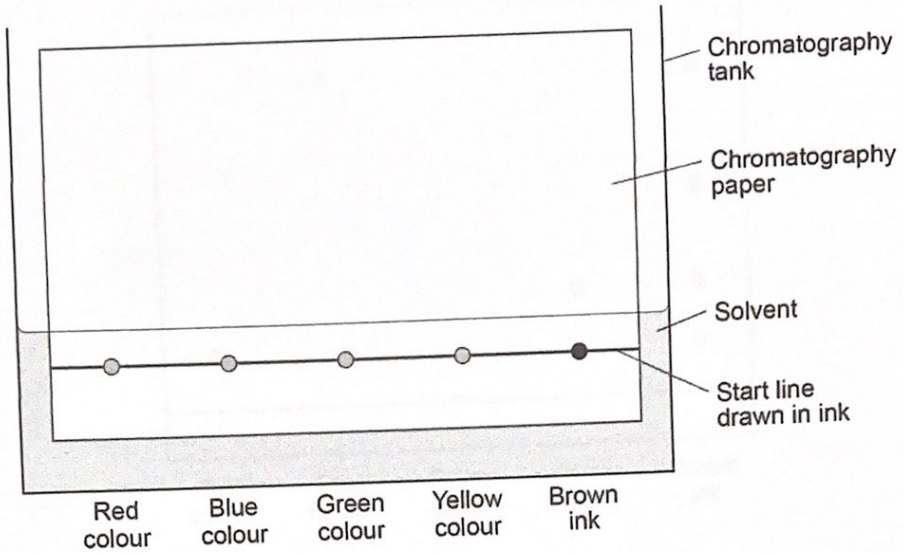
mmerevise.co.uk

Do not write outside the box

0 1 A student investigated the colours in a brown ink using chromatography.

0 1 . 1 **Figure 1** shows the apparatus used.

Figure 1



Give **two** errors made by the student.

Describe the problem each error would cause.

[4 marks]

Error 1 Starting line is drawn with ink not pencil.

Problem 1 ink may be dissolved itself and mix with the solvent.

Error 2 The solvent level is above the start line

Problem 2 Colours will dissolve in the solvent without moving up the chromatography paper.

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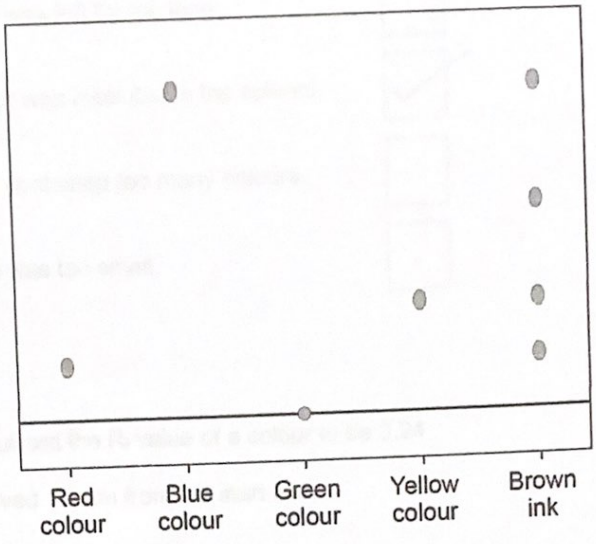
A different student set up the apparatus correctly.

Figure 2 shows the results.

Figure 2



0 1 . 2 Give **two** conclusions the student can make from **Figure 2** about the four colours in the brown ink.

[2 marks]

1 The brown ink contains red, blue and yellow colours in it.

2 The brown ink does not contain green ink.

Question 1 continues on the next page

Do not write outside the box

0 1 . 3 Why was the green colour still on the start line at the end of the experiment? **[1 mark]**

Tick (✓) **one** box.

- The experiment was left for too long. ☐
- The green colour was insoluble in the solvent. ☑
- The green spot contained too many colours. ☐
- The green spot was too small. ☐

0 1 . 4 A student calculated the R_f value of a colour to be 0.24

The colour moved 1.8 cm from the start line.

Calculate the distance the solvent moved.

Use the equation:

$$R_f = \frac{\text{distance moved by colour}}{\text{distance moved by solvent}}$$

[3 marks]

$0.24 = \frac{1.8}{\text{distance moved by solvent}}$

$\text{distance moved by solvent} = \frac{1.8}{0.24} = 7.5$

$\Rightarrow 7.5$ cm

Distance moved by solvent = 7.5 cm

10

Do not write outside the box

0 2 . 1 Water that is safe to drink is called potable water.

Compare how easily potable water can be obtained from:

- waste water (sewage)
- ground water (fresh water).

[6 marks]

Waste water is harder to use as more processes are necessary to clean it. Hence, it also requires more time. First large particles would have to be removed with screening. Then other particles remaining should be sedimented out and removed. Next it has to go through a biological treatment to reduce the amount of solid waste. Microbes break down and remove some of the sewage solid waste. Then remaining water needs to be sterilised by chlorine or UV radiation. On the other hand ground water is easier to make into potable water as less processes are required. It can be filtered through sand and gravel and screens to remove sediments first. Secondly sterilised the same way with UV radiation or chlorine to kill microorganism. This would be sufficient to make ground water potable.

Question 2 continues on the next page

Do not write outside the box

A scientist produced potable water from 150 cm^3 of salty water.

0 2 . 2 Which process can be used to produce potable water from salty water?

[1 mark]

Tick (✓) **one** box.

- Distillation ☑
- Electrolysis ☐
- Filtration ☐
- Sterilisation ☐

0 2 . 3 The salty water contains sodium chloride.

The scientist collected 2.40 g of sodium chloride from 150 cm^3 of salty water.

Calculate the concentration of sodium chloride in grams per dm^3

[3 marks]

$150 cm^3 \rightarrow 0.15 dm^3$

Concentration = $2.40 / 0.15 = 16 g/dm^3$

Concentration of sodium chloride = 16 g/dm^3

10

Do not write outside the box

0 3 This question is about the reaction between sodium thiosulfate solution and hydrochloric acid.

The equation for the reaction is:

$$Na_2S_2O_3(aq) + 2HCl(aq) \rightarrow 2NaCl(aq) + H_2O(l) + SO_2(g) + S(s)$$

0 3 . 1 The mass of the conical flask and contents was greater at the start of the reaction than at the end.

Explain why.

[2 marks]

SO_2 (sulfur dioxide) is a product, which is a gas, that escapes the flask not adding to its mass any more.

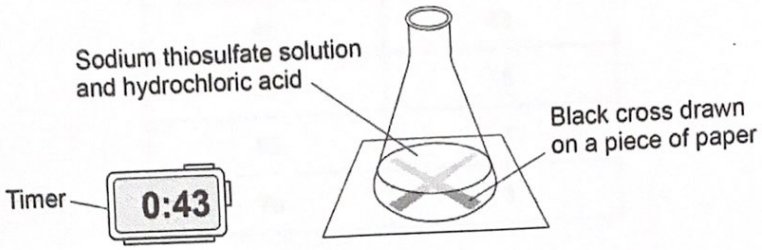
Question 3 continues on the next page

A teacher demonstrated the reaction between sodium thiosulfate solution and hydrochloric acid.

Figure 3 shows the experiment.

The experiment was done in a fume cupboard.

Figure 3



This is the method the teacher used.

1. Pour 50 cm^3 of sodium thiosulfate solution into a conical flask.
2. Put the conical flask on a black cross drawn on a piece of paper.
3. Pour 10 cm^3 of hydrochloric acid into the conical flask and start a timer.
4. Stop the timer when the cross can no longer be seen.
5. Repeat the experiment at different temperatures.

0 3 . 2 What type of variable is time in this reaction? **[1 mark]**

Tick (✓) **one** box.

Control ☐

Dependent ☑

Independent ☐

0 3 . 3 **Table 1** shows the results.

Table 1

Temperature in °C	Time in seconds
19	82
32	48
45	43
52	15
63	7
73	3

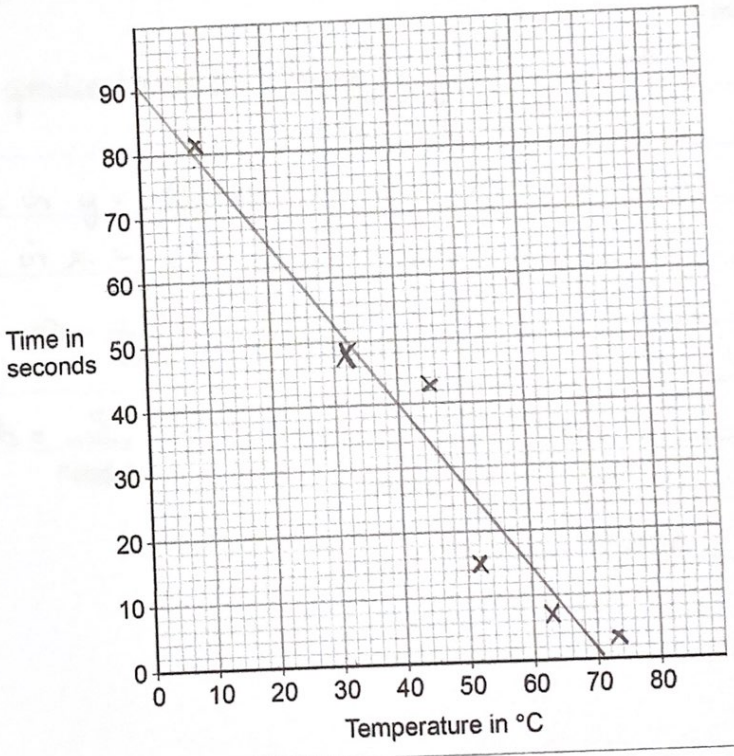
Complete **Figure 4**.

You should:

- plot the data from **Table 1** on **Figure 4**
- draw a line of best fit.

[3 marks]

Figure 4

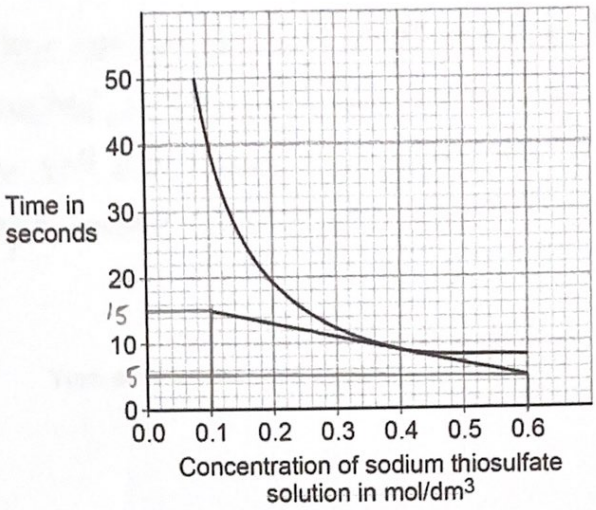


Do not write outside the box

0 3 . 4 A student investigated the effect of concentration of sodium thiosulfate on the time taken for the reaction at room temperature.

Figure 5 shows the results with a tangent drawn at 0.4 mol/dm^3

Figure 5



Calculate the gradient (slope) of the tangent at 0.4 mol/dm^3

Give the unit.

[4 marks]

gradient (rate) = $\frac{\text{Change in } y}{\text{Change in } x}$

Change in y = 5 − 15 = −10

Change in x = 0.6 − 0.1 = 0.5

$\Rightarrow \frac{-10}{0.5} = -20$

units = $\frac{s}{mol/dm^3} \Rightarrow \frac{s \times dm^3}{mol} \Rightarrow s\,dm^3/mol$

Gradient = −20

Unit = $s\,dm^3/mol$

Do not write outside the box

0 3 . 5 The student determined the **rate** of the reaction at regular time intervals during an experiment.

Explain why the **rate** decreased during the reaction.

You should give your answer in terms of particles.

[2 marks]

As the reaction goes on more and more particles have already reacted, so less and less particles are left per unit volume still able to react. Therefore, the frequency of successful ~~reaction~~ collisions decreases.

12

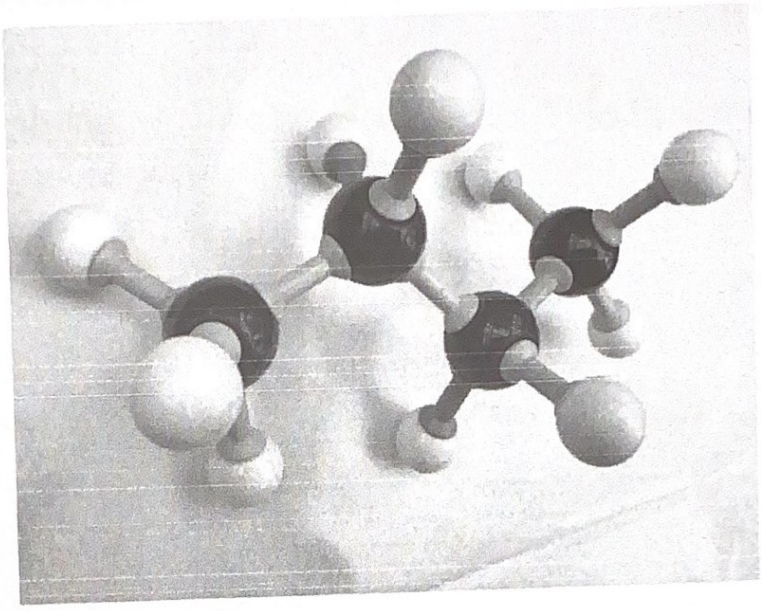
Turn over for the next question

Do not write outside the box

0 4 This question is about hydrocarbons and the uses of hydrocarbons.

0 4 . 1 **Figure 6** shows a model of an alkane.

Figure 6



What is the name of the alkane in **Figure 6**? **[1 mark]**

butane

0 4 . 2 What is a hydrocarbon? **[1 mark]**

A molecule which is made up of carbon and hydrogen atoms only.

Do not write outside the box

Large hydrocarbon molecules are cracked.

0 4 . 3 When $C_{11}H_{24}$ is cracked, three products are formed.

Complete the equation for the reaction. **[2 marks]**

$$C_{11}H_{24} \rightarrow C_5H_{10} + 2\ C_2H_4 + C_2H_6$$

0 4 . 4 Explain why **one** of the products of cracking is in high demand. **[2 marks]**

C_2H_6 is a useful fuel source and is highly flamable as its a shorter chain.

Question 4 continues on the next page

Do not write outside the box

0 4 . 5 Window frames can be manufactured from wood or from plastic.

Table 2 shows data from a life cycle assessment (LCA) for a wooden window frame and a plastic window frame.

Both window frames are the same size.

Table 2

	Wood	Plastic
Sources of hydrocarbons used for production in kg	5.37	18.23
Greenhouse gases released during production, use and disposal in kg equivalent of CO_2	457	487
Oxides of nitrogen and sulfur dioxide produced in arbitrary units	29.6	37.7
Waste materials in kg	16.5	28.8
Total energy consumption in production, use and disposal in MJ	9150	9713
Lifetime cost to customer to buy and maintain in £	147	102

Do not write outside the box

Evaluate the sustainability of wooden and plastic window frames.

You should include environmental and economic factors. **[6 marks]**

Plastic frames are responsible for the release of more greenhouse gases in production and disposal this contributes to global warming more than wooden frames. They also produce more oxides of nitrogen and sulfur dioxide which can lead to harmful acid rains. Plastic frames also use more hydrocarbons in their production, which is a non-renewable source, unlike wood. They also produce more waste material and use more energy to produce and dispose of.
However their lifetime cost is lower as well as their maintainance cost. This will benefit customers. Overall, while wooden frames cost more through maintenence and lifetime cost, they would be a better option as they require less energy to produce and cause less of an impact on the environment.

12

Turn over for the next question

Do not write outside the box

0 5 This question is about the Earth's atmosphere and the Earth's resources.

0 5 . 1 After the formation of the Earth's early atmosphere, the amounts of nitrogen and oxygen in the atmosphere changed.

Explain the main changes in the amounts of nitrogen and oxygen in the Earth's atmosphere.

[4 marks]

Nitrogen Nitrogen concentration increased in the atmosphere as nitrogen gas was released into it through volcanic action.

Oxygen Oxygen concentration also increased as photosynthetic algae and plants produced oxygen

0 5 . 2 Describe how coal was formed from the carbon dioxide present in the Earth's early atmosphere.

[4 marks]

CO_2 (carbon dioxide) is taken up by photosynthesising plants, such as trees. When these trees die they are covered in a layer of sediments and compressed. Over millions of years and under high pressure from this compression the organic matter from trees is compressed to form coal.

0 5 . 3 The combustion of 1.0 kg of coal produces more carbon dioxide than the combustion of 1.0 kg of natural gas.

Suggest why.

[1 mark]

Coal has a higher proportion of carbon in it than natural gas.

Do not write outside the box

Metals are extracted from metal ores found in the Earth.

0 5 . 4 Describe how bioleaching is used to extract copper from low grade ores. **[3 marks]**

Bacteria is used to convert compounds in copper ores into a solution. This solution still contains these copper compounds, but can be used as a liquid in electrolysis. The electrolysis of this solution obtains copper from its compounds.

0 5 . 5 Phytomining uses plants to extract nickel from low grade ores.

The plants contain 0.792% nickel by mass.

The plants are burned to produce ash.

The ash from these plants contains 4.80% nickel by mass.

Calculate the mass of ash produced from burning 1000 kg of plants.

Give your answer in grams in standard form. **[4 marks]**

1000 kg - 7.92 kg of nickel
(because 100 kg would give 0.792% so 0.792 kg)

mass = $\frac{7.92}{4.8} \times 100 = 165$ kg

1000 g = 1 kg so 165 kg = 165 × 1000 = 165 000 g
$\Rightarrow 1.65 \times 10^5$ g

Mass of ash (in standard form) = 1.65×10^5 g

16

Do not write outside the box

0 6 This question is about catalysts and equilibrium.

0 6 . 1 What type of substance is a catalyst in biological systems?

[1 mark]

Tick (✓) **one** box.

- Algae ☐
- Alkene ☐
- Enzyme ☑
- Formulation ☐

0 6 . 2 Explain how a catalyst increases the rate of a reaction.

[2 marks]

A catalyst provides the reaction with an alternative reaction pathway, which requires a lower amount of activation energy. So more particles will have enough energy to successfully collide and react.

Do not write outside the box

The reversible reaction for the production of ammonia is:

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

0 6 . 3 What can scientists predict using Le Chatelier's Principle? **[1 mark]**

How the changing of conditions will effect the shift/position of the equilibrium.

0 6 . 4 Describe how a reversible chemical reaction is able to reach equilibrium. **[2 marks]**

If in a closed system; where no product or reactant can get in or out eventually the ~~rate~~ rate of the forward and the backwards reaction will be the same.

0 6 . 5 Explain the effect of increasing the pressure on the yield of ammonia. **[2 marks]**

Increasing the pressure would increase the yield, as there is more moles of gas on the left than on the right.

4 moles on left - 2 moles on right.

0 6 . 6 The forward reaction to produce ammonia is exothermic.

Explain the effect of increasing the temperature on the yield of ammonia. **[2 marks]**

This would decrease the yield as increasing the temperature would favour the endothermic backwards reaction. Shifting the equilibrium to the left.

10

END OF QUESTIONS