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Centre number						Candidate number				
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**OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GENERAL CERTIFICATE OF SECONDARY EDUCATION**

A321/01

**TWENTY FIRST CENTURY SCIENCE
CHEMISTRY A**

Unit 1: Modules C1 C2 C3 (Foundation Tier)

MONDAY 17 JANUARY 2011: Morning

DURATION: 40 minutes

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

Candidates answer on the question paper.

A calculator may be used for this paper.

OCR SUPPLIED MATERIALS:

None

OTHER MATERIALS REQUIRED:

Pencil

Ruler (cm/mm)

READ INSTRUCTIONS OVERLEAF

INSTRUCTIONS TO CANDIDATES

- **Write your name, centre number and candidate number in the boxes on the first page. Please write clearly and in capital letters.**
- **Use black ink. Pencil may be used for graphs and diagrams only.**
- **Read each question carefully. Make sure you know what you have to do before starting your answer.**
- **Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).**
- **Answer ALL the questions.**

INFORMATION FOR CANDIDATES

- **The number of marks is given in brackets [] at the end of each question or part question.**
- **The total number of marks for this paper is 42.**
- **The Periodic Table is provided.**

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QUESTION 1 STARTS ON PAGE 4

Answer ALL the questions.

1 This question is about food additives.

(a) Look at this list of types of food additive.

ARTIFICIAL SWEETENERS COLOURINGS
EMULSIFIERS FLAVOURINGS PRESERVATIVES

Begin each of these sentences by using the correct word or words from the list.

_____ help to mix
ingredients together.

_____ are used instead
of sugar in processed foods.

_____ keep food safe to
eat for longer. [3]

(b) Some food additives have E numbers. For example, E300 is vitamin C.

E numbers are listed on food labels.

Which of these statements about these additives are TRUE and which are FALSE?

Put ticks (✓) in the correct boxes to show your choices.

	TRUE	FALSE
They are always harmful to health.		
All are artificial chemicals.		
They have passed a safety test.		
Some are natural chemicals.		
They have been approved for use in the EU.		
They have been approved for use throughout the world.		

[3]

(c) Mary is shopping at a supermarket.

She looks to see which E numbers are listed on the label of each food packet.

Mary buys foods with some E numbers.

She chooses NOT to buy foods with other E numbers.

Use ideas of RISK AND BENEFIT to suggest how Mary decides which foods to buy.

[2]

[Total: 8]

- 2 (a) Plants need nitrogen to make amino acids and proteins.

Which THREE other elements are present in amino acids and proteins?

Put a **ring** around each correct answer.

ARGON CALCIUM CARBON HELIUM

HYDROGEN OXYGEN POTASSIUM

PHOSPHORUS SODIUM

[2]

- (b) Some elements move between plants, animals and the environment.

Write down TWO ways that this happens.

[2]

(c) Farmers add nitrogen compounds to the soil.

Which two statements explain why they need to do this?

Put ticks (✓) in the boxes next to the TWO correct answers.

Nitrogen is a gas so it escapes from the soil.

Plants take nitrogen compounds from the soil as they grow.

Nitrogen kills weeds that grow in the soil.

Nitrogen kills pests that attack the crops.

When crops are harvested, nitrogen is not returned to the soil.

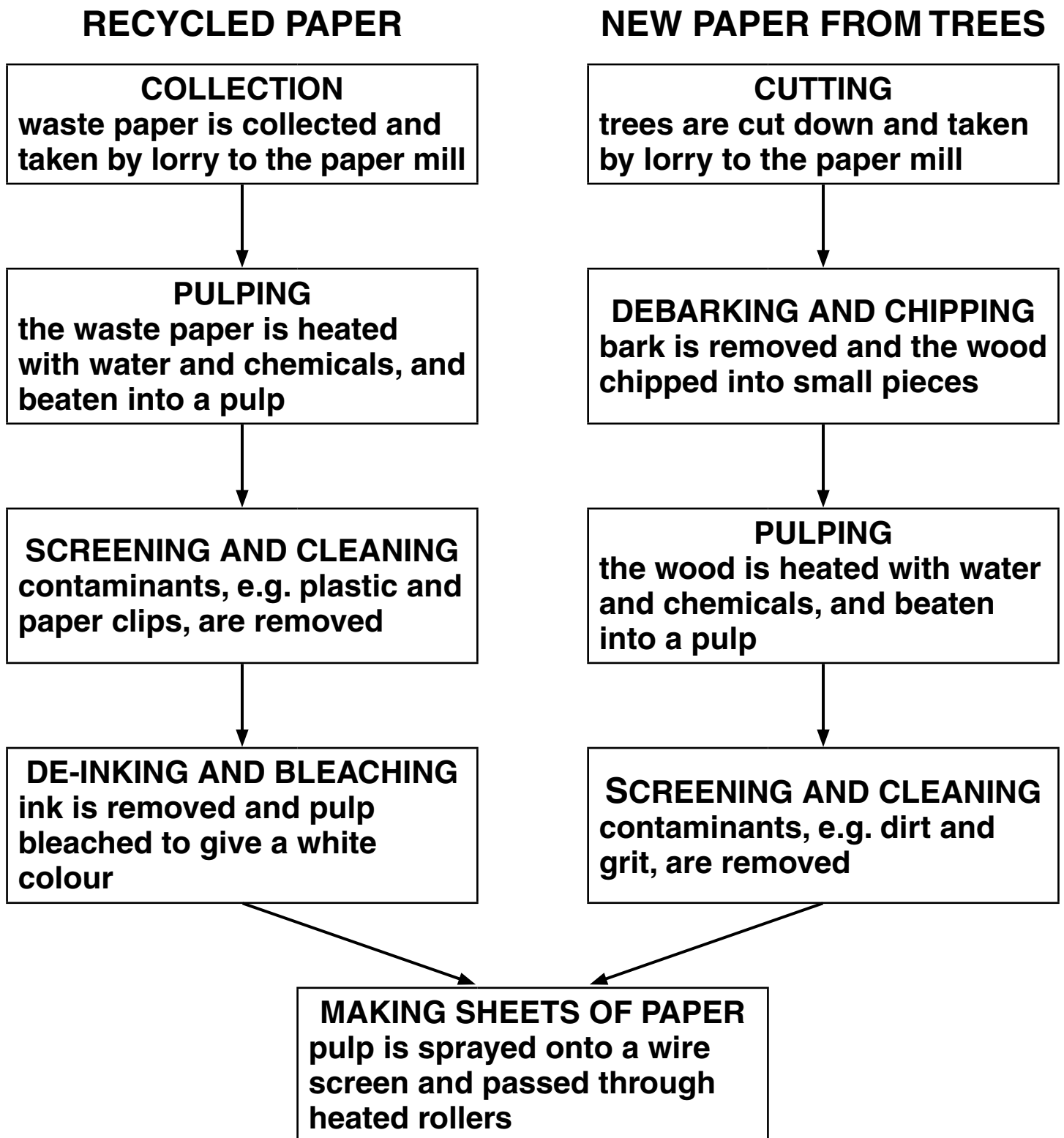
[2]

[Total: 6]

3 Newspapers are printed on paper.

Paper can be made from recycled waste paper or from trees.

The diagram shows the main steps in the production of **RECYCLED PAPER** and **NEW PAPER FROM TREES**.



- (a) The sustainability of making recycled paper and making new paper may be different.**

Explain how.

Use ideas from the diagram to help you answer the question.

[3]

- (b) Making sheets of paper from pulp is the same for recycled paper and new paper.**

Name one OTHER step in the diagram that has the same environmental impact for both types of paper.

Explain your choice.

[2]

(c) Waste paper can be disposed of in landfill or burned.

Waste paper can also be recycled.

All of the statements below are true.

Which statements are good reasons for recycling waste paper?

Put ticks (✓) in the boxes next to the TWO best answers.

Recycling needs waste paper to be de-inked and bleached using chemicals.

Waste paper can be burned in power stations to produce electricity.

Paper can be separated from other waste by householders, and collected.

Paper in landfill slowly rots and gives off methane, which contributes to global warming.

Pulping waste paper uses chemicals and energy.

Burning waste paper gives off carbon dioxide.

[2]

[Total: 7]

4 This question is about crude oil and polymers made from it.

(a) Crude oil is a mixture of hydrocarbons.

Which elements are present in hydrocarbons?

Put ticks (✓) in the boxes next to the TWO correct answers.

argon	<input type="checkbox"/>
carbon	<input type="checkbox"/>
hydrogen	<input type="checkbox"/>
oxygen	<input type="checkbox"/>
sodium	<input type="checkbox"/>

[2]

(b) Small molecules obtained from crude oil are joined together to make polymers.

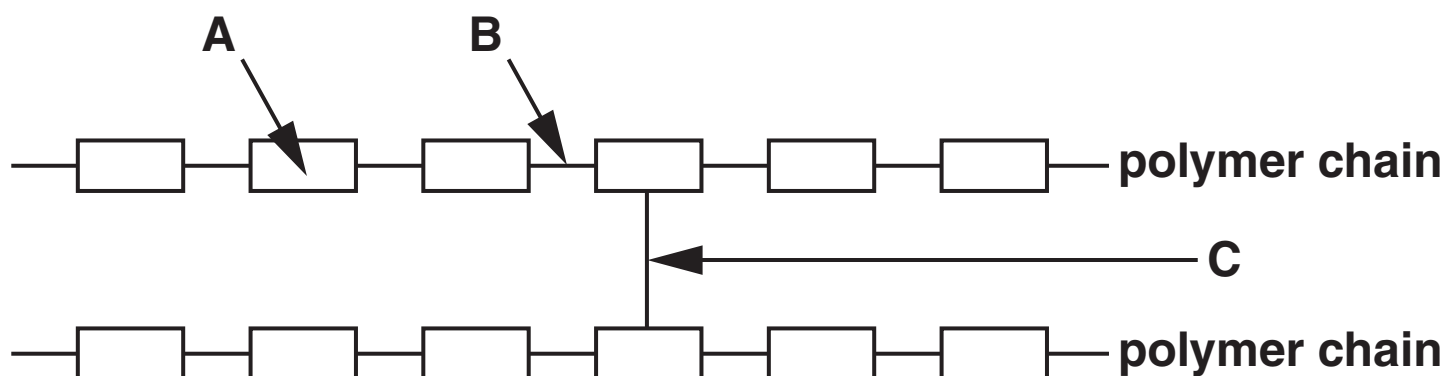
What is the name of this process?

Put a **ring** around the correct word.

DECOMPOSITION NEUTRALISATION
PHOTOSYNTHESIS POLYMERISATION
OXIDATION

[1]

(c) The diagram shows where each of three different forces of attraction, A, B and C, are in a polymer.



(i) Which force joins the small molecules to each other to make a polymer chain?

Choose from A, B or C.

answer _____ [1]

(ii) Which force is a cross-link between chains?

Choose from A, B or C.

answer _____ [1]

(iii) Which statements describe changes that increase the melting point of this polymer?

Put ticks (✓) in the boxes next to the TWO best answers.

make the polymer chains longer

introduce more cross-links

put plasticizer molecules between the chains

make force A stronger

make force B stronger

[2]

[Total: 7]

5 Molecules in petrol contain hydrogen and carbon atoms.

(a) When petrol burns in a car engine the carbon reacts with oxygen to make carbon dioxide.

What is made from the hydrogen?

Put a ring around the correct answer.

ARGON CARBON MONOXIDE

NITROGEN DIOXIDE WATER

[1]

- (b) Car manufacturers state the amount of carbon dioxide made in the engines in their cars.

The table gives this information for different size engines fitted in the same design of car.

SIZE OF ENGINE IN LITRES	CARBON DIOXIDE MADE IN g/km TRAVELLED
1.4	158
1.6	184
2.0	207
2.6	224

Complete this sentence to describe the **CORRELATION** shown by this data.

As the size of the car engine

_____ , the mass

of carbon dioxide made

_____ .

[1]

(c) A car manufacturer designs a new engine.

Scientists compare the carbon dioxide made by the new engine with that from the old engine.

Both engines are the same size.

The scientists test both engines five times. They work out the mean (average) of the five results for the new engine to be 144 g/km. They use this as the best estimate of the carbon dioxide made by the new engine.

	CARBON DIOXIDE MADE IN g/km TRAVELLED				
	test 1	test 2	test 3	test 4	test 5
NEW ENGINE	145	146	143	144	142
OLD ENGINE	160	158	159	157	156

(i) Work out the best estimate of carbon dioxide made by the old engine.

Show your working.

best estimate = _____ g/km [2]

- (ii) The carbon dioxide output measured for the new engine was a little different in every test.

Which statements explain these differences?

Put ticks (✓) in the boxes next to the TWO best answers.

The scientists used different apparatus for some of the tests.

There is a limit to the accuracy of the apparatus used to measure the carbon dioxide.

Different hydrocarbons in the petrol were burning from minute to minute.

The amount of carbon dioxide made by an engine varies a little from minute to minute.

The scientists made mistakes with some of the tests.

[2]

(iii) Motorists pay car tax each year.

The tax is based on the amount of carbon dioxide the car makes.

The table gives information for annual car tax payments (2009 figures).

CARBON DIOXIDE IN g/km TRAVELLED	CAR TAX IN £
up to 100	0
101–120	35
121–150	120
151–165	145
166–185	170
over 185	210

Use the table to find the car tax for the car fitted with the NEW engine.

car tax = £ _____ [1]

- (iv) There are several ways that the **TOTAL** amount of carbon dioxide released from vehicles can be reduced.

Which of these statements describe some of them?

Put ticks (✓) in the boxes next to the **TWO** best answers.

fitting catalytic converters

using low sulfur fuels

more people using public transport instead of cars

increasing the speed limit on motorways

having emission limits enforced by MOT testing of cars

[2]

[Total: 9]

6 This list shows pollutants found in a sample of air.

CARBON DIOXIDE

CARBON MONOXIDE

CARBON PARTICULATES

SULFUR DIOXIDE

(a) Which TWO of these pollutants are removed from the air when they dissolve in rain water?

_____ and

[1]

(b) Carbon monoxide causes harm to humans DIRECTLY because it is toxic.

Some other pollutants cause harm to humans INDIRECTLY.

Use one example from the list to explain how a pollutant can be INDIRECTLY harmful.

_____ [2]

(c) Carbon monoxide reacts with oxygen to produce carbon dioxide.

Finish the diagram to show the molecules in this reaction.



carbon monoxide

oxygen

carbon dioxide

[2]

[Total: 5]

END OF QUESTION PAPER

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The Periodic Table of the Elements

	1	2	3	4	5	6	7	0																						
	1 H hydrogen 1							4 He helium 2																						
	Key relative atomic mass atomic symbol name atomic (proton) number																													
7 Li lithium 3	9 Be beryllium 4	24 Mg magnesium 12	11 Na sodium 11	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10																						
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	63.5 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	77 Se selenium 34	80 Br bromine 35	84 Kr krypton 36													
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	[98] Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	127 I iodine 53	128 Te tellurium 52	131 Xe xenon 54	[223] Fr francium 87	[226] Ra radium 88	[227] Ac* actinium 89	[261] Rf rutherfordium 104	[262] Db dubnium 105	[266] Sg seaborgium 106	[264] Bh bohrium 107	[277] Hs hassium 108	[268] Mt meitnerium 109	[271] Ds darmstadtium 110	[272] Rg roentgenium 111	[209] Po polonium 84	[210] At astatine 85	[222] Rn radon 86
Elements with atomic numbers 112-116 have been reported but not fully authenticated																														

* The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.