

Please check the examination details below before entering your candidate information

Candidate surname		Other names	
Pearson Edexcel International Advanced Level		Centre Number 	Candidate Number
Thursday 21 May 2020			
Morning (Time: 1 hour 30 minutes)		Paper Reference WCH12/01	
Chemistry International Advanced Subsidiary / Advanced Level Unit 2: Energetics, Group Chemistry, Halogenoalkanes and Alcohols			
Candidates must have: Scientific calculator Data Booklet Ruler			Total Marks

Instructions

- Use **black** ink or **black** ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*

Information

- The total mark for this paper is 80.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*
- In the question marked with an **asterisk** (*), marks will be awarded for your ability to structure your answer logically, showing how the points that you make are related or follow on from each other where appropriate.
- There is a Periodic Table on the back cover of this paper.

Advice

- Read each question carefully before you start to answer it.
- Show all your working in calculations and include units where appropriate.
- Check your answers if you have time at the end.

Turn over ►

P62588A

©2020 Pearson Education Ltd.

1/1/1/1/1/1/




Pearson

SECTION A

Answer ALL the questions in this section.

You should aim to spend no more than 20 minutes on this section.

For each question, select one answer from A to D and put a cross in the box ☐. If you change your mind, put a line through the box ☒ and then mark your new answer with a cross ☐.

- 1 The bond enthalpy for the Cl—Cl bond is $+243.0 \text{ kJ mol}^{-1}$.

What is the enthalpy change of atomisation of chlorine in kJ mol^{-1} ?

- ☐ A $+243.0$
☐ B -243.0
☐ C $+121.5$
☐ D -121.5

(Total for Question 1 = 1 mark)

- 2 The standard enthalpy change of neutralisation for the reaction between sodium hydroxide solution and hydrochloric acid is -56 kJ mol^{-1} .

Which row in the table is correct for this neutralisation?

	Reaction type	Temperature
☐ A	exothermic	increases
☐ B	exothermic	decreases
☐ C	endothermic	increases
☐ D	endothermic	decreases

(Total for Question 2 = 1 mark)

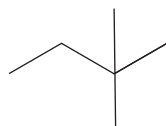
- 3 Which of the following statements about water is **not** due to hydrogen bonding?

- ☐ A water has a less open structure than ice
☐ B ice cubes float in a glass of iced water
☐ C when water freezes its volume increases
☐ D water is a good solvent for ionic compounds

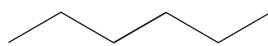
(Total for Question 3 = 1 mark)



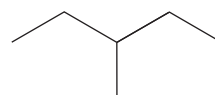
4 The skeletal formulae of three isomers are shown.



X



Y



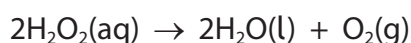
Z

Which series shows the correct order of **increasing** boiling temperatures?

- ☐ A Y, X, Z
☐ B X, Y, Z
☐ C Y, Z, X
☐ D X, Z, Y

(Total for Question 4 = 1 mark)

5 Hydrogen peroxide decomposes in the presence of a catalyst.



(a) What type of reaction occurs?

(1)

- ☐ A displacement
☐ B disproportionation
☐ C elimination
☐ D hydrolysis

(b) In an experiment, the volume of oxygen produced by the decomposition of hydrogen peroxide was measured at various times as the reaction progressed and a graph was plotted.

The initial gradient of the graph was $0.50 \text{ cm}^3 \text{ s}^{-1}$.

What is the initial rate of decomposition of hydrogen peroxide in mol s^{-1} ?

[Molar volume of a gas at r.t.p. = $24 \text{ dm}^3 \text{ mol}^{-1}$]

(1)

- ☐ A $2.1 \times 10^{-2} \text{ mol s}^{-1}$
☐ B $4.2 \times 10^{-5} \text{ mol s}^{-1}$
☐ C $2.1 \times 10^{-5} \text{ mol s}^{-1}$
☐ D $1.0 \times 10^{-5} \text{ mol s}^{-1}$

(Total for Question 5 = 2 marks)



6 Dichromate(VI) ions may be reduced in acidic solution.



The coefficients in this half-equation are

	x	y	z
☐ A	14	6	7
☐ B	14	3	7
☐ C	7	6	3.5
☐ D	7	3	3.5

(Total for Question 6 = 1 mark)

7 In an oxide of potassium, the oxidation number of oxygen is $-\frac{1}{2}$.

What is the formula of this oxide?

- ☐ A K_2O
- ☐ B K_2O_2
- ☐ C K_2O_3
- ☐ D KO_2

(Total for Question 7 = 1 mark)

Use this space for any rough working. Anything you write in this space will gain no credit.



8 Compound **Q** gives off nitrogen dioxide when heated, and produces a red colour in a flame test.

(a) Which of these compounds could be **Q**?

(1)

- ☐ **A** barium nitrate
- ☐ **B** lithium nitrate
- ☐ **C** magnesium nitrate
- ☐ **D** rubidium nitrate

(b) Which colour and test results are correct for nitrogen dioxide gas?

(1)

	Colour of nitrogen dioxide	Colour change of damp litmus paper
☐ A	brown	blue to red
☐ B	brown	red to blue
☐ C	colourless	blue to red
☐ D	colourless	red to blue

(Total for Question 8 = 2 marks)

9 The products of the reaction of sodium fluoride with concentrated sulfuric acid can be predicted by considering the trends for the other sodium halides.

Which gas or gases form when sodium fluoride reacts with concentrated sulfuric acid?

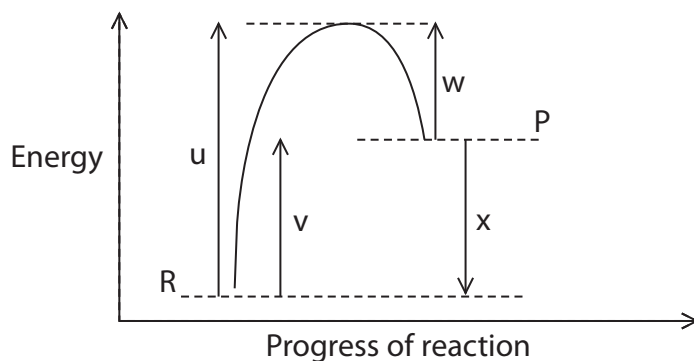
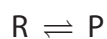
- ☐ **A** hydrogen fluoride only
- ☐ **B** hydrogen fluoride and fluorine only
- ☐ **C** hydrogen fluoride and sulfur dioxide only
- ☐ **D** hydrogen fluoride, fluorine and sulfur dioxide only

(Total for Question 9 = 1 mark)

Use this space for any rough working. Anything you write in this space will gain no credit.



10 The diagram shows a reaction profile for a reversible reaction.



(a) Which symbol represents the enthalpy change for the reaction $R \rightarrow P$?

(1)

- ☐ **A** u
- ☐ **B** v
- ☐ **C** w
- ☐ **D** x

(b) Which symbol represents the activation energy of the reaction $P \rightarrow R$?

(1)

- ☐ **A** u
- ☐ **B** v
- ☐ **C** w
- ☐ **D** x

(c) Hess's Law can be applied to this system.

Which expression is correct?

(1)

- ☐ **A** $v + x = u + w$
- ☐ **B** $w + x = u$
- ☐ **C** $u - w = v$
- ☐ **D** $u - v = x$

(Total for Question 10 = 3 marks)



- 11 A solution containing 0.100 mol of hydrochloric acid is added to 8.43 g of magnesium carbonate.



- (a) What is the total volume (at r.t.p.) of carbon dioxide formed?

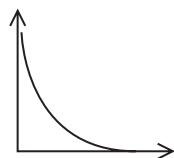
$[M_r(\text{MgCO}_3) = 84.3 \quad \text{Molar volume of a gas at r.t.p.} = 24.0 \text{ dm}^3 \text{ mol}^{-1}]$

(1)

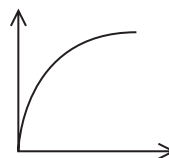
- ☐ A 2.40 dm^3
☐ B 1.20 dm^3
☐ C 2400 dm^3
☐ D 1200 dm^3

- (b) Which sketch graph shows the volume of carbon dioxide (y-axis) plotted against time (x-axis) during the reaction?

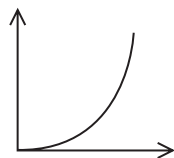
(1)



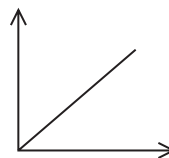
☐ A



☐ B



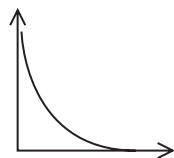
☐ C



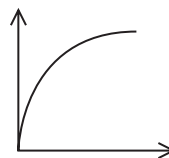
☐ D

- (c) Which sketch graph shows the rate of the reaction (y-axis) plotted against time (x-axis) during the reaction?

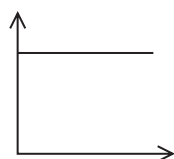
(1)



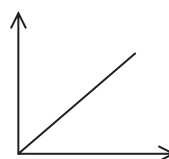
☐ A



☐ B



☐ C

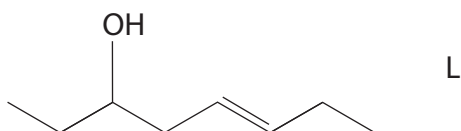


☐ D

(Total for Question 11 = 3 marks)



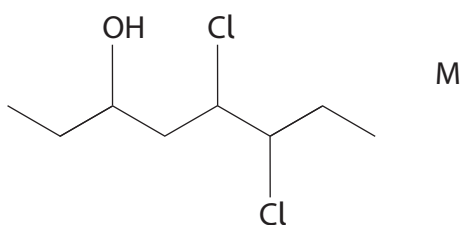
12 (a) What is the name of compound L?



(1)

- ☐ A Z-oct-3-en-3-ol
- ☐ B E-oct-3-en-3-ol
- ☐ C Z-oct-5-en-3-ol
- ☐ D E-oct-5-en-3-ol

(b) Compound L can be converted into compound M.

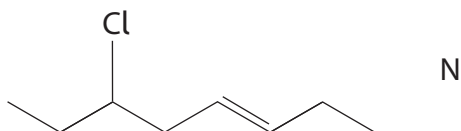


Which reagent should be used?

(1)

- ☐ A $\text{Cl}_2(\text{g})$
- ☐ B $\text{HCl}(\text{g})$
- ☐ C $\text{PCl}_5(\text{s})$
- ☐ D $\text{KCl}(\text{aq})$

(c) Compound L can also be converted into compound N.



Which reagent should be used?

(1)

- ☐ A $\text{Cl}_2(\text{g})$
- ☐ B $\text{HCl}(\text{g})$
- ☐ C $\text{PCl}_5(\text{s})$
- ☐ D $\text{KCl}(\text{aq})$

(Total for Question 12 = 3 marks)

TOTAL FOR SECTION A = 20 MARKS



SECTION B

Answer ALL the questions. Write your answers in the spaces provided.

13 Enthalpy changes of formation are often difficult to determine directly.

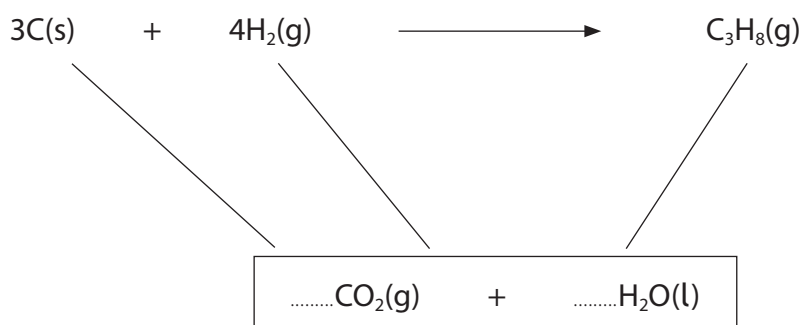
Some enthalpy data are shown.

Compound	Standard enthalpy change of formation, $\Delta_f H^\ominus$ / kJ mol ⁻¹
H ₂ O(l)	-285.8
CO ₂ (g)	-393.5

Standard enthalpy change of combustion of propane ($\Delta_c H^\ominus$ (C₃H₈)) = -2219 kJ mol⁻¹.

(a) (i) Add arrowheads and stoichiometric coefficients to the Hess's Law diagram.

(1)



(ii) Use the data at the start of the question and your Hess's Law diagram to calculate the standard enthalpy change of formation of propane. Include a sign and units in your answer.

(2)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



- (b) The values for the boiling temperatures and the standard enthalpies of combustion of a series of straight-chain alkanes are shown in the table.

Alkane	Boiling temperature / °C	Standard enthalpy change of combustion, $\Delta_c H^\ominus$ / kJ mol ⁻¹	Increase in $\Delta_c H^\ominus$ / kJ mol ⁻¹
C ₂ H ₆	-88.5	-1560	-
C ₃ H ₈	-42.0	-2219	659
C ₄ H ₁₀	-0.5	-2877	658
C ₅ H ₁₂	36.1	-3509	632
C ₆ H ₁₄	68.8	-4163	654
C ₇ H ₁₆	98.4	-4817	654

- (i) Explain why the increases in the values of $\Delta_c H^\ominus$ are similar.

(2)

- (ii) The increase in the value of $\Delta_c H^\ominus$ from butane to pentane is smaller than any other increase.

Suggest an explanation for this.

(2)



- (iii) Explain, with reference to their intermolecular forces, why the boiling temperatures of **alkanes** increase as the number of carbon atoms increases. A detailed description of the intermolecular forces is not required.

(3)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total for Question 13 = 10 marks)



14 Limewater is a solution of calcium hydroxide used in the laboratory to test for carbon dioxide.

- (a) Write the equation for the formation of the white precipitate in this test. Include state symbols.

(2)

- (b) The concentration of a saturated solution of calcium hydroxide can be determined by titration.

25.0 cm³ portions of a saturated solution of calcium hydroxide were titrated with 0.0500 mol dm⁻³ hydrochloric acid using phenolphthalein indicator. The mean titre was 23.40 cm³.

Calculate the concentration of calcium hydroxide in g dm⁻³.
Give your answer to an appropriate number of significant figures.

[$M_r(\text{Ca}(\text{OH})_2) = 74.1$]

(4)

- (c) The experiment was repeated using the same hydrochloric acid with a saturated solution of magnesium hydroxide.

Explain the difference (if any) in the mean titre.

(2)

.....

.....

.....

.....

(Total for Question 14 = 8 marks)



- 15 (a) Silver ions have anti-microbial properties and are used in some wound dressings. Silver nitrate can be made by warming a mixture of silver metal and concentrated nitric acid.



Show, by reference to oxidation numbers, that this is a redox reaction.

(2)

.....

.....

.....

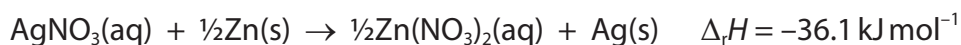
.....

.....

.....

- (b) Two students used different methods to determine the concentration of a silver nitrate solution.

- (i) Student A used a calorimetric method, reacting a 50.0 cm^3 sample of the solution with excess powdered zinc.



The student recorded a maximum rise in temperature of 5.2°C .

Calculate the concentration of the silver nitrate solution in mol dm^{-3} .

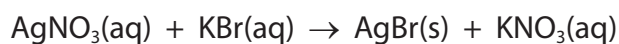
[Assume the specific heat capacity of the solution is $4.18\text{ J g}^{-1}^\circ\text{C}^{-1}$ and the density of the solution is 1.00 g cm^{-3} .]

(3)



- (ii) Student B used a gravimetric method, which involved weighing a product of a reaction.

A 50.0 cm^3 sample of the same silver nitrate solution was mixed with excess potassium bromide solution. The precipitate was filtered and weighed.



The mass of the precipitate was found to be 5.96 g.

Calculate the concentration of the silver nitrate solution, in mol dm^{-3} , from this gravimetric method.

(2)

- (iii) The students' values were different from the data book value. Student A's value was lower and student B's value was higher. Give a possible reason for each difference.

(2)

.....

.....

.....

.....

.....

.....

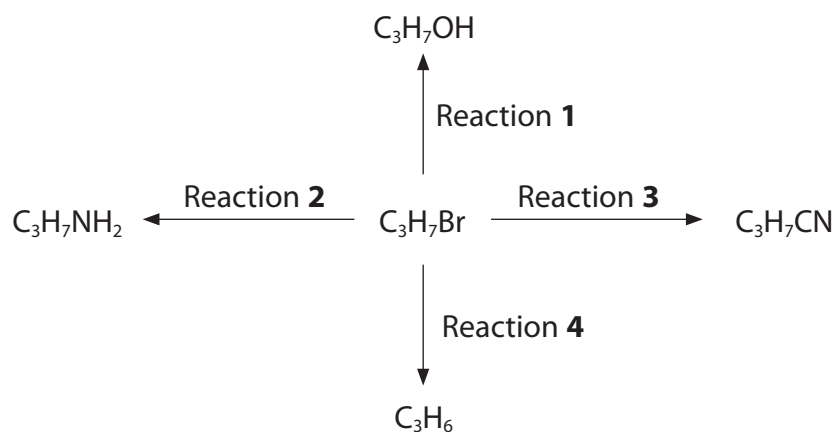
.....

(Total for Question 15 = 9 marks)



16 Halogenoalkanes are useful reagents in organic synthesis.

Some reactions of 1-bromopropane are shown.



(a) Complete the table about these reactions.

(4)

Reaction	Reagent	Solvent	Type of reaction
1	potassium hydroxide		
2	ammonia		
3		ethanol	
4			elimination

(b) Give the IUPAC name of the product of Reaction 3.

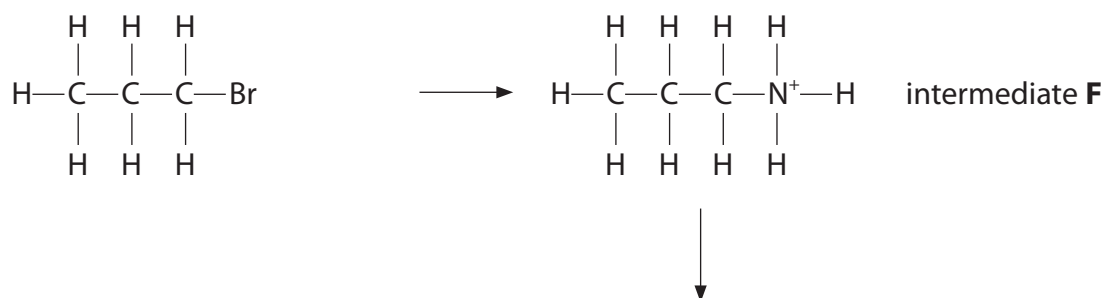
(1)



(c) Complete the mechanism for Reaction 2.

Show the formation of the intermediate **F** and of the product.
Include curly arrows, and any relevant lone pairs and dipoles.

(3)



*(d) The relative rates of hydrolysis of a series of halogenoalkanes were determined using the following method:

- five test tubes, each containing 2 cm^3 of ethanol and 2 cm^3 of aqueous silver nitrate, were placed in a water bath at 50°C
- four drops of a different halogenoalkane were added to each test tube
- the time taken for a precipitate to appear in each test tube was recorded.

The results are shown.

Halogenoalkane	Time for ppt to appear / s
2-bromobutane	29
2-chlorobutane	75
2-iodobutane	<1
1-bromobutane	41
2-bromo-2-methylbutane	13

Explain these results by considering:

- the chemical reaction occurring
- the structures of the halogenoalkanes
- the strengths of the carbon-halogen bonds.

(6)



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total for Question 16 = 14 marks)

TOTAL FOR SECTION B = 41 MARKS

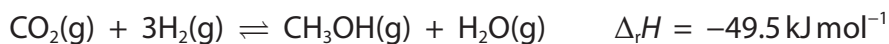


P 6 2 5 8 8 A 0 1 9 2 4

SECTION C

Answer ALL the questions. Write your answers in the spaces provided.

- 17** (a) The concentration of atmospheric carbon dioxide is at its highest level for 800 000 years. Carbon Capture and Utilisation (CCU) uses waste carbon dioxide from industrial processes to make green fuels, methanol, plastics or pharmaceuticals. One method uses the reaction between carbon dioxide and hydrogen to make methanol.



The conditions for this industrial reaction are a pressure of 50 atm, a temperature of 250 °C and a copper catalyst.

- (i) Explain why high pressure is used.

(2)

.....

.....

.....

.....

.....

- (ii) Discuss the factors leading to a choice of 250 °C in this process.

(3)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



(iii) Give a reason why using a catalyst to increase the rate makes the process more sustainable.

(1)

.....

.....

.....

(b) Methanol can be oxidised to produce methanoic acid.

(i) State the reagents and reaction conditions for this oxidation in the laboratory.

(2)

.....

.....

.....

(ii) Complete the equation to show the products of this oxidation.
State symbols are not required.

(1)



(iii) Give a chemical test, and its positive result, that could be used to confirm the functional group in methanoic acid.

(2)

.....

.....

.....

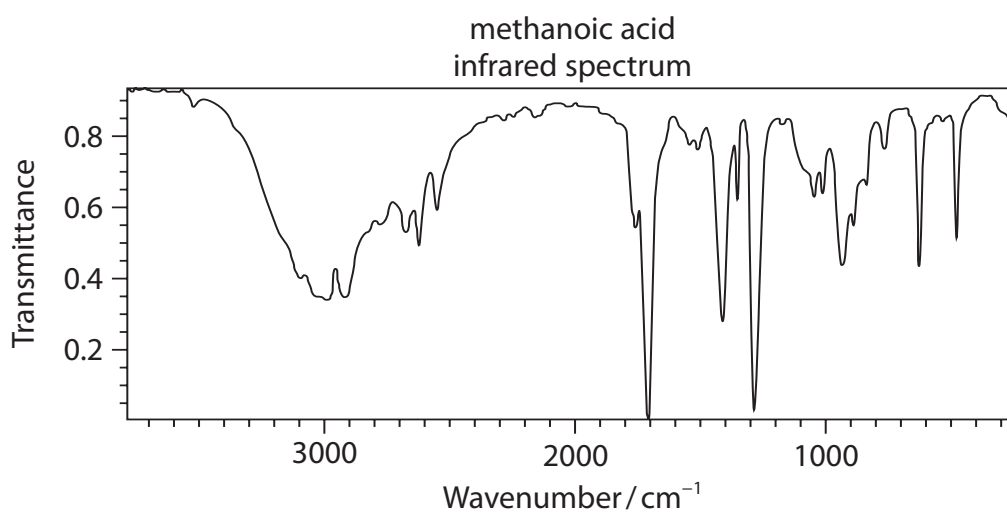
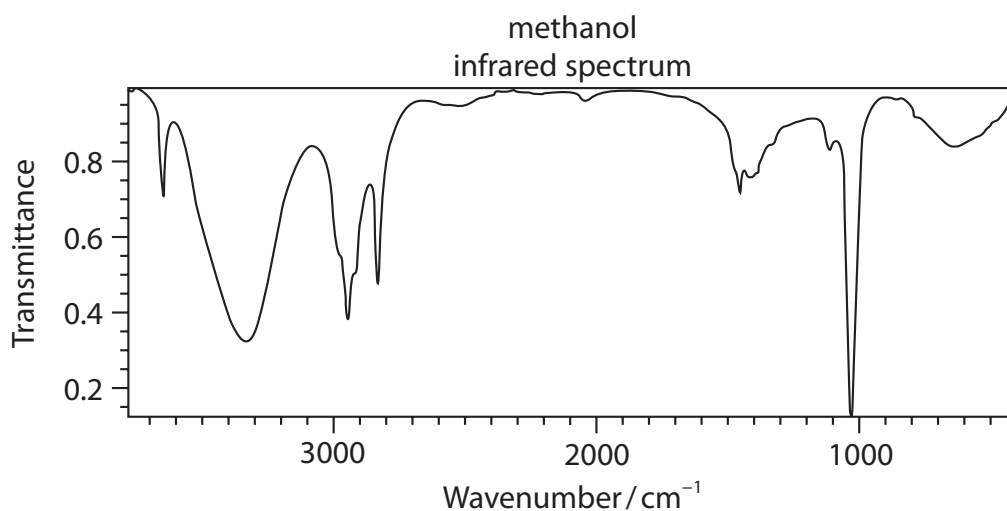
.....

.....



- (iv) The infrared spectra of methanol and methanoic acid are shown.
Explain how these could be used to show that **all** the methanol has been converted to methanoic acid, quoting relevant bonds and wavenumbers.
Use your Data Booklet.

(3)



- (c) (i) Methanol produced from petrol by CCU may be mixed with petrol derived from fossil fuels. A concentration of 5% by mass of methanol is used.

Explain how the use of this fuel would affect the increase in global temperatures.

(2)

- (ii) Calculate the mass of carbon dioxide released when 1 mol of octane (C_8H_{18}) is burned completely.

(1)

- (iii) A motorist who uses 1200 kg of fuel each year in a car changes to a fuel with 5% of the mass of petrol replaced by methanol produced by CCU.

Calculate the annual reduction, in kg, of carbon dioxide released by the car.

[Assume petrol has the same molecular formula as octane and the added methanol does not contribute any additional carbon dioxide when burned.]

(2)

(Total for Question 17 = 19 marks)

TOTAL FOR SECTION C = 19 MARKS
TOTAL FOR PAPER = 80 MARKS



The Periodic Table of Elements

1	2	3	4	5	6	7	0 (8)
6.9 Li lithium 3	9.0 Be beryllium 4	10.8 B boron 5	12.0 C carbon 6	14.0 N nitrogen 7	16.0 O oxygen 8	19.0 F fluorine 9	20.2 Ne neon 10
23.0 Na sodium 11	24.3 Mg magnesium 12	27.0 Al aluminium 13	28.1 Si silicon 14	31.0 P phosphorus 15	32.1 S sulfur 16	35.5 Cl chlorine 17	39.9 Ar argon 18
39.1 K potassium 19	40.1 Ca calcium 20	69.7 Ga gallium 31	72.6 Ge germanium 32	74.9 As arsenic 33	79.0 Se selenium 34	79.9 Br bromine 35	83.8 Kr krypton 36
85.5 Rb rubidium 37	87.6 Sr strontium 38	114.8 In indium 49	118.7 Sn tin 50	121.8 Sb antimony 51	127.6 Te tellurium 52	126.9 I iodine 53	131.3 Xe xenon 54
132.9 Cs caesium 55	137.3 Ba barium 56	204.4 Tl thallium 81	207.2 Pb lead 82	209.0 Bi bismuth 83	209.0 Po polonium 84	210.0 At astatine 85	222.0 Rn radon 86
223.0 Fr francium 87	226.0 Ra radium 88	200.6 Hg mercury 80	201.0 Tl thallium 81	204.4 Pb lead 82	207.2 Bi bismuth 83	209.0 Po polonium 84	210.0 At astatine 85
227.0 Ac actinium 89	227.0 Th thorium 90	232.0 Pa protactinium 91	238.0 U uranium 92	238.0 Np neptunium 93	242.0 Pu plutonium 94	244.0 Am americium 95	247.0 Cm curium 96
238.0 Th thorium 90	238.0 Pa protactinium 91	238.0 U uranium 92	238.0 Np neptunium 93	242.0 Pu plutonium 94	244.0 Am americium 95	247.0 Cm curium 96	250.0 Bk berkelium 97
250.0 Cf californium 98	250.0 Es einsteinium 99	250.0 Fm fermium 100	250.0 Md mendelevium 101	250.0 No nobelium 102	250.0 Lr lawrencium 103	250.0 Rf rutherfordium 104	250.0 Db dubnium 105
250.0 Sg seaborgium 106	250.0 Bh bohrium 107	250.0 Hs hassium 108	250.0 Ds darmstadtium 110	250.0 Rg roentgenium 111	250.0 Uue ununoctium 112	250.0 Uuh ununhexium 118	250.0 Uus ununseptium 119
250.0 Uuq ununquadium 120	250.0 Uup ununpentium 124	250.0 Uub ununbium 126	250.0 Uut ununtrium 129	250.0 Uuq ununquadium 130	250.0 Uup ununpentium 134	250.0 Uub ununbium 136	250.0 Uut ununtrium 139
250.0 Uuh ununhexium 142	250.0 Uus ununseptium 144	250.0 Uuo ununoctium 146	250.0 Uuq ununquadium 150	250.0 Uup ununpentium 152	250.0 Uub ununbium 154	250.0 Uut ununtrium 156	250.0 Uuq ununquadium 158
250.0 Uuh ununhexium 162	250.0 Uus ununseptium 164	250.0 Uuo ununoctium 166	250.0 Uuq ununquadium 170	250.0 Uup ununpentium 172	250.0 Uub ununbium 174	250.0 Uut ununtrium 176	250.0 Uuq ununquadium 178
250.0 Uuh ununhexium 182	250.0 Uus ununseptium 184	250.0 Uuo ununoctium 186	250.0 Uuq ununquadium 190	250.0 Uup ununpentium 192	250.0 Uub ununbium 194	250.0 Uut ununtrium 196	250.0 Uuq ununquadium 198
250.0 Uuh ununhexium 202	250.0 Uus ununseptium 204	250.0 Uuo ununoctium 206	250.0 Uuq ununquadium 210	250.0 Uup ununpentium 212	250.0 Uub ununbium 214	250.0 Uut ununtrium 216	250.0 Uuq ununquadium 218
250.0 Uuh ununhexium 222	250.0 Uus ununseptium 224	250.0 Uuo ununoctium 226	250.0 Uuq ununquadium 230	250.0 Uup ununpentium 232	250.0 Uub ununbium 234	250.0 Uut ununtrium 236	250.0 Uuq ununquadium 238
250.0 Uuh ununhexium 242	250.0 Uus ununseptium 244	250.0 Uuo ununoctium 246	250.0 Uuq ununquadium 250	250.0 Uup ununpentium 252	250.0 Uub ununbium 254	250.0 Uut ununtrium 256	250.0 Uuq ununquadium 258
250.0 Uuh ununhexium 262	250.0 Uus ununseptium 264	250.0 Uuo ununoctium 266	250.0 Uuq ununquadium 270	250.0 Uup ununpentium 272	250.0 Uub ununbium 274	250.0 Uut ununtrium 276	250.0 Uuq ununquadium 278
250.0 Uuh ununhexium 282	250.0 Uus ununseptium 284	250.0 Uuo ununoctium 286	250.0 Uuq ununquadium 290	250.0 Uup ununpentium 292	250.0 Uub ununbium 294	250.0 Uut ununtrium 296	250.0 Uuq ununquadium 298
250.0 Uuh ununhexium 292	250.0 Uus ununseptium 294	250.0 Uuo ununoctium 296	250.0 Uuq ununquadium 300	250.0 Uup ununpentium 302	250.0 Uub ununbium 304	250.0 Uut ununtrium 306	250.0 Uuq ununquadium 308
250.0 Uuh ununhexium 302	250.0 Uus ununseptium 304	250.0 Uuo ununoctium 306	250.0 Uuq ununquadium 310	250.0 Uup ununpentium 312	250.0 Uub ununbium 314	250.0 Uut ununtrium 316	250.0 Uuq ununquadium 318
250.0 Uuh ununhexium 312	250.0 Uus ununseptium 314	250.0 Uuo ununoctium 316	250.0 Uuq ununquadium 320	250.0 Uup ununpentium 322	250.0 Uub ununbium 324	250.0 Uut ununtrium 326	250.0 Uuq ununquadium 328
250.0 Uuh ununhexium 322	250.0 Uus ununseptium 324	250.0 Uuo ununoctium 326	250.0 Uuq ununquadium 330	250.0 Uup ununpentium 332	250.0 Uub ununbium 334	250.0 Uut ununtrium 336	250.0 Uuq ununquadium 338
250.0 Uuh ununhexium 332	250.0 Uus ununseptium 334	250.0 Uuo ununoctium 336	250.0 Uuq ununquadium 340	250.0 Uup ununpentium 342	250.0 Uub ununbium 344	250.0 Uut ununtrium 346	250.0 Uuq ununquadium 348
250.0 Uuh ununhexium 342	250.0 Uus ununseptium 344	250.0 Uuo ununoctium 346	250.0 Uuq ununquadium 350	250.0 Uup ununpentium 352	250.0 Uub ununbium 354	250.0 Uut ununtrium 356	250.0 Uuq ununquadium 358
250.0 Uuh ununhexium 352	250.0 Uus ununseptium 354	250.0 Uuo ununoctium 356	250.0 Uuq ununquadium 360	250.0 Uup ununpentium 362	250.0 Uub ununbium 364	250.0 Uut ununtrium 366	250.0 Uuq ununquadium 368
250.0 Uuh ununhexium 362	250.0 Uus ununseptium 364	250.0 Uuo ununoctium 366	250.0 Uuq ununquadium 370	250.0 Uup ununpentium 372	250.0 Uub ununbium 374	250.0 Uut ununtrium 376	250.0 Uuq ununquadium 378
250.0 Uuh ununhexium 372	250.0 Uus ununseptium 374	250.0 Uuo ununoctium 376	250.0 Uuq ununquadium 380	250.0 Uup ununpentium 382	250.0 Uub ununbium 384	250.0 Uut ununtrium 386	250.0 Uuq ununquadium 388
250.0 Uuh ununhexium 382	250.0 Uus ununseptium 384	250.0 Uuo ununoctium 386	250.0 Uuq ununquadium 390	250.0 Uup ununpentium 392	250.0 Uub ununbium 394	250.0 Uut ununtrium 396	250.0 Uuq ununquadium 398
250.0 Uuh ununhexium 392	250.0 Uus ununseptium 394	250.0 Uuo ununoctium 396	250.0 Uuq ununquadium 400	250.0 Uup ununpentium 402	250.0 Uub ununbium 404	250.0 Uut ununtrium 406	250.0 Uuq ununquadium 408
250.0 Uuh ununhexium 402	250.0 Uus ununseptium 404	250.0 Uuo ununoctium 406	250.0 Uuq ununquadium 410	250.0 Uup ununpentium 412	250.0 Uub ununbium 414	250.0 Uut ununtrium 416	250.0 Uuq ununquadium 418
250.0 Uuh ununhexium 412	250.0 Uus ununseptium 414	250.0 Uuo ununoctium 416	250.0 Uuq ununquadium 420	250.0 Uup ununpentium 422	250.0 Uub ununbium 424	250.0 Uut ununtrium 426	250.0 Uuq ununquadium 428
250.0 Uuh ununhexium 422	250.0 Uus ununseptium 424	250.0 Uuo ununoctium 426	250.0 Uuq ununquadium 430	250.0 Uup ununpentium 432	250.0 Uub ununbium 434	250.0 Uut ununtrium 436	250.0 Uuq ununquadium 438
250.0 Uuh ununhexium 432	250.0 Uus ununseptium 434	250.0 Uuo ununoctium 436	250.0 Uuq ununquadium 440	250.0 Uup ununpentium 442	250.0 Uub ununbium 444	250.0 Uut ununtrium 446	250.0 Uuq ununquadium 448
250.0 Uuh ununhexium 432	250.0 Uus ununseptium 434	250.0 Uuo ununoctium 436	250.0 Uuq ununquadium 440	250.0 Uup ununpentium 442	250.0 Uub ununbium 444	250.0 Uut ununtrium 446	250.0 Uuq ununquadium 448
250.0 Uuh ununhexium 432	250.0 Uus ununseptium 434	250.0 Uuo ununoctium 436	250.0 Uuq ununquadium 440	250.0 Uup ununpentium 442	250.0 Uub ununbium 444	250.0 Uut ununtrium 446	250.0 Uuq ununquadium 448
250.0 Uuh ununhexium 432	250.0 Uus ununseptium 434	250.0 Uuo ununoctium 436	250.0 Uuq ununquadium 440	250.0 Uup ununpentium 442	250.0 Uub ununbium 444	250.0 Uut ununtrium 446	250.0 Uuq ununquadium 448
250.0 Uuh ununhexium 432	250.0 Uus ununseptium 434	250.0 Uuo ununoctium 436	250.0 Uuq ununquadium 440	250.0 Uup ununpentium 442	250.0 Uub ununbium 444	250.0 Uut ununtrium 446	250.0 Uuq ununquadium 448
250.0 Uuh ununhexium 432	250.0 Uus ununseptium 434	250.0 Uuo ununoctium 436	250.0 Uuq ununquadium 440	250.0 Uup ununpentium 442	250.0 Uub ununbium 444	250.0 Uut ununtrium 446	250.0 Uuq ununquadium 448
250.0 Uuh ununhexium 432	250.0 Uus ununseptium 434	250.0 Uuo ununoctium 436	250.0 Uuq ununquadium 440	250.0 Uup ununpentium 442	250.0 Uub ununbium 444	250.0 Uut ununtrium 446	250.0 Uuq ununquadium 448
250.0 Uuh ununhexium 432	250.0 Uus ununseptium 434	250.0 Uuo ununoctium 436	250.0 Uuq ununquadium 440	250.0 Uup ununpentium 442	250.0 Uub ununbium 444	250.0 Uut ununtrium 446	250.0 Uuq ununquadium 448
250.0 Uuh ununhexium 432	250.0 Uus ununseptium 434	250.0 Uuo ununoctium 436	250.0 Uuq ununquadium 440	250.0 Uup ununpentium 442	250.0 Uub ununbium 444	250.0 Uut ununtrium 446	250.0 Uuq ununquadium 448
250.0 Uuh ununhexium 432	250.0 Uus ununseptium 434	250.0 Uuo ununoctium 436	250.0 Uuq ununquadium 440	250.0 Uup ununpentium 442	250.0 Uub ununbium 444	250.0 Uut ununtrium 446	250.0 Uuq ununquadium 448
250.0 Uuh ununhexium 432	250.0 Uus ununseptium 434	250.0 Uuo ununoctium 436	250.0 Uuq ununquadium 440	250.0 Uup ununpentium 442	250.0 Uub ununbium 444	250.0 Uut ununtrium 446	250.0 Uuq ununquadium 448
250.0 Uuh ununhexium 432	250.0 Uus ununseptium 434	250.0 Uuo ununoctium 436	250.0 Uuq ununquadium 440	250.0 Uup ununpentium 442	250.0 Uub ununbium 444	250.0 Uut ununtrium 446	250.0 Uuq ununquadium 448
250.0 Uuh ununhexium 432	250.0 Uus ununseptium 434	250.0 Uuo ununoctium 436	250.0 Uuq ununquadium 440	250.0 Uup ununpentium 442	250.0 Uub ununbium 444	250.0 Uut ununtrium 446	250.0 Uuq ununquadium 448
250.0 Uuh ununhexium 432	250.0 Uus ununseptium 434	250.0 Uuo ununoctium 436	250.0 Uuq ununquadium 440	250.0 Uup ununpentium 442	250.0 Uub ununbium 444	250.0 Uut ununtrium 446	250.0 Uuq ununquadium 448
250.0 Uuh ununhexium 432	250.0 Uus ununseptium 434	250.0 Uuo ununoctium 436	250.0 Uuq ununquadium 440	250.0 Uup ununpentium 442	250.0 Uub ununbium 444	250.0 Uut ununtrium 446	250.0 Uuq ununquadium 448
250.0 Uuh ununhexium 432	250.0 Uus ununseptium 434	250.0 Uuo ununoctium 436	250.0 Uuq ununquadium 440	250.0 Uup ununpentium 442	250.0 Uub ununbium 444	250.0 Uut ununtrium 446	250.0 Uuq ununquadium 448
250.0 Uuh ununhexium 432	250.0 Uus ununseptium 434	250.0 Uuo ununoctium 436	250.0 Uuq ununquadium 440	250.0 Uup ununpentium 442	250.0 Uub ununbium 444	250.0 Uut ununtrium 446	250.0 Uuq ununquadium 448
250.0 Uuh ununhexium 432	250.0 Uus ununseptium 434	250.0 Uuo ununoctium 436	250.0 Uuq ununquadium 440	250.0 Uup ununpentium 442	250.0 Uub ununbium 444	250.0 Uut ununtrium 446	250.0 Uuq ununquadium 448
250.0 Uuh ununhexium 432	250.0 Uus ununseptium 434	250.0 Uuo ununoctium 436	25				