

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Centre Number

Candidate Number

--	--	--	--	--

--	--	--	--

October 2021

Pearson Edexcel International Advanced Level**Time** 1 hour 20 minutes**Paper****reference****WCH13/01****Chemistry****International Advanced Subsidiary/Advanced Level****UNIT 3: Practical Skills in Chemistry I****You must have:**

Scientific calculator, 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 50.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*
- You will be assessed on your ability to organise and present information, ideas, descriptions and arguments clearly and logically, including your use of grammar, punctuation and spelling.
- 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 ►

P69461A

©2021 Pearson Education Ltd.

E:1/1/1/1/1/



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

1 This question is about some compounds of strontium.

(a) State a test for the strontium cation, giving the expected result.

(2)

.....

.....

(b) An unlabelled bottle was thought to contain solid strontium chloride.

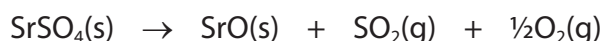
A sample of the solid was dissolved in distilled water for tests to identify the anion.

Complete the table to give the expected results of the anion tests.

(2)

Reagent added for test	Expected result for the strontium chloride solution
Barium chloride acidified with hydrochloric acid	
Silver nitrate acidified with nitric acid	

(c) Anhydrous strontium sulfate undergoes thermal decomposition at approximately 1300 °C.



Suggest why this decomposition is unlikely to be possible in a school laboratory.

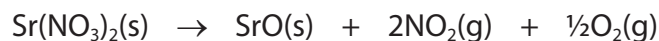
(1)

.....

.....



(d) Anhydrous strontium nitrate decomposes at 570 °C.



(i) Describe how to ensure the strontium nitrate decomposes fully.

(1)

(ii) State the colour of nitrogen dioxide gas.

(1)

(iii) Give the test for oxygen and the expected positive result.

(1)

(iv) The solid residue from the decomposition was added to distilled water.

Give **one** observation for the reaction that takes place, identifying the product of the reaction by name or formula.

(2)

Observation

Product

(Total for Question 1 = 10 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

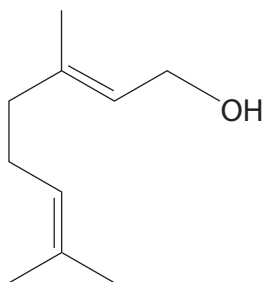


2 Geraniol is used in perfumes and can be extracted from many plants.

Data on geraniol are shown.

Solubility in water	Melting temperature / °C	Boiling temperature / °C	Density / g cm ⁻³
insoluble	-15	230	0.889

The structure of geraniol is shown.



(a) Geraniol has **two** different types of functional group.

Name the functional groups, giving a chemical test and its positive result to show the presence of each group.

(4)

First functional group:

.....

.....

.....

.....

Second functional group:

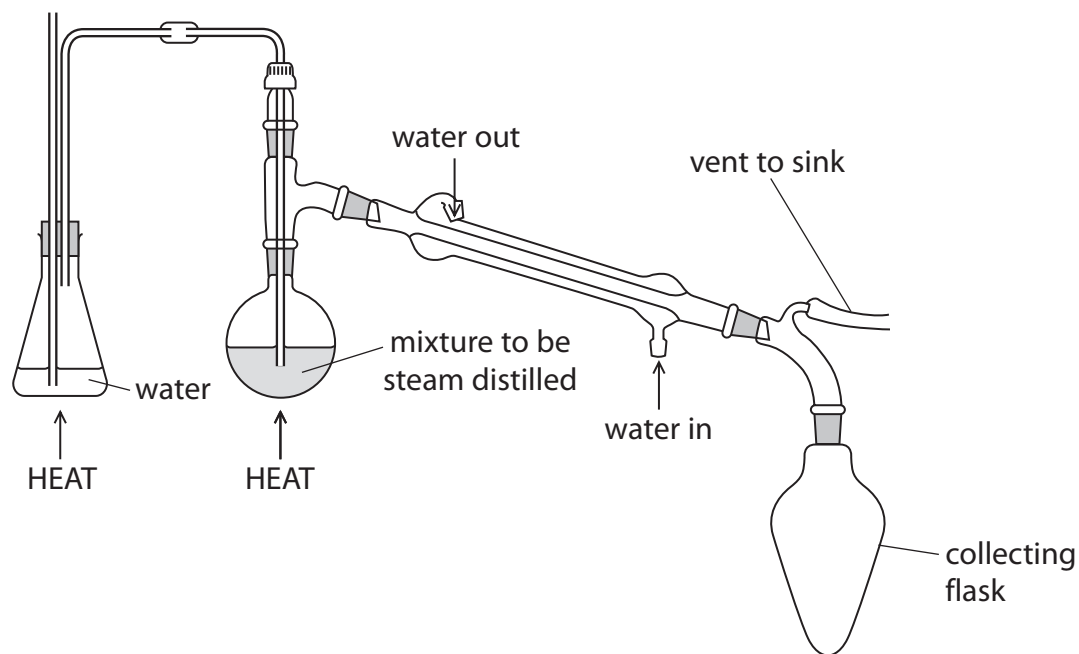
.....

.....

.....

.....

(b) Geraniol is extracted by steam distillation.



The steam distillation product is geraniol and water. The water may contain dissolved impurities which have similar boiling temperatures to geraniol.

The contents of the collecting flask are transferred to a piece of apparatus used to separate the geraniol from the water layer.

Draw a labelled diagram of this apparatus and its contents.

(3)



(c) The geraniol will still contain small quantities of water.

Describe how to produce a sample of pure, dry geraniol using a named drying agent.

(3)

.....

.....

.....

.....

.....

.....

(d) The hazard labels for pure geraniol are shown.

		
.....		

(i) Complete the table to identify the hazards indicated by the symbols.

(2)

- (ii) State **one** precaution, other than wearing safety spectacles and a laboratory coat, that should be taken when using pure geraniol to reduce the risk associated with the hazard symbol shown.



(1)

- (e) State the appearance of the flame when geraniol is ignited.

(1)

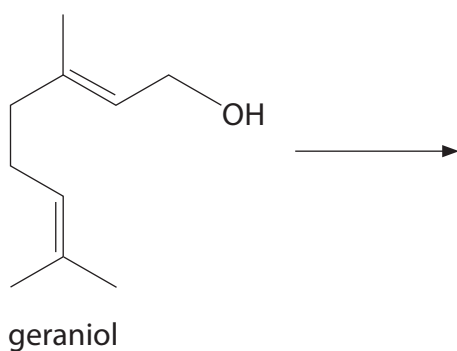
- (f) Geraniol reacts with **excess** hydrogen gas.

- (i) State the essential condition required for this reaction.

(1)

- (ii) Draw the **skeletal** formula of the product of this reaction.

(1)



(Total for Question 2 = 16 marks)

- 3 A student carried out experiments to determine the enthalpy change for the hydration of anhydrous copper(II) sulfate, CuSO_4 , to form hydrated copper(II) sulfate crystals, $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$.

To find the enthalpy change of solution of anhydrous copper(II) sulfate, 25.0 cm^3 of distilled water was placed in a polystyrene cup and the temperature measured at one minute intervals.

After 2.5 minutes, 7.50 g of anhydrous copper(II) sulfate was added and the mixture stirred continuously.

The results are shown.

Time / minutes	0	1	2	2.5	3	4	5	6	7	8
Temperature / $^{\circ}\text{C}$	21.1	21.0	21.0	X	34.2	37.6	36.9	36.1	35.2	34.3

DO NOT WRITE IN THIS AREA

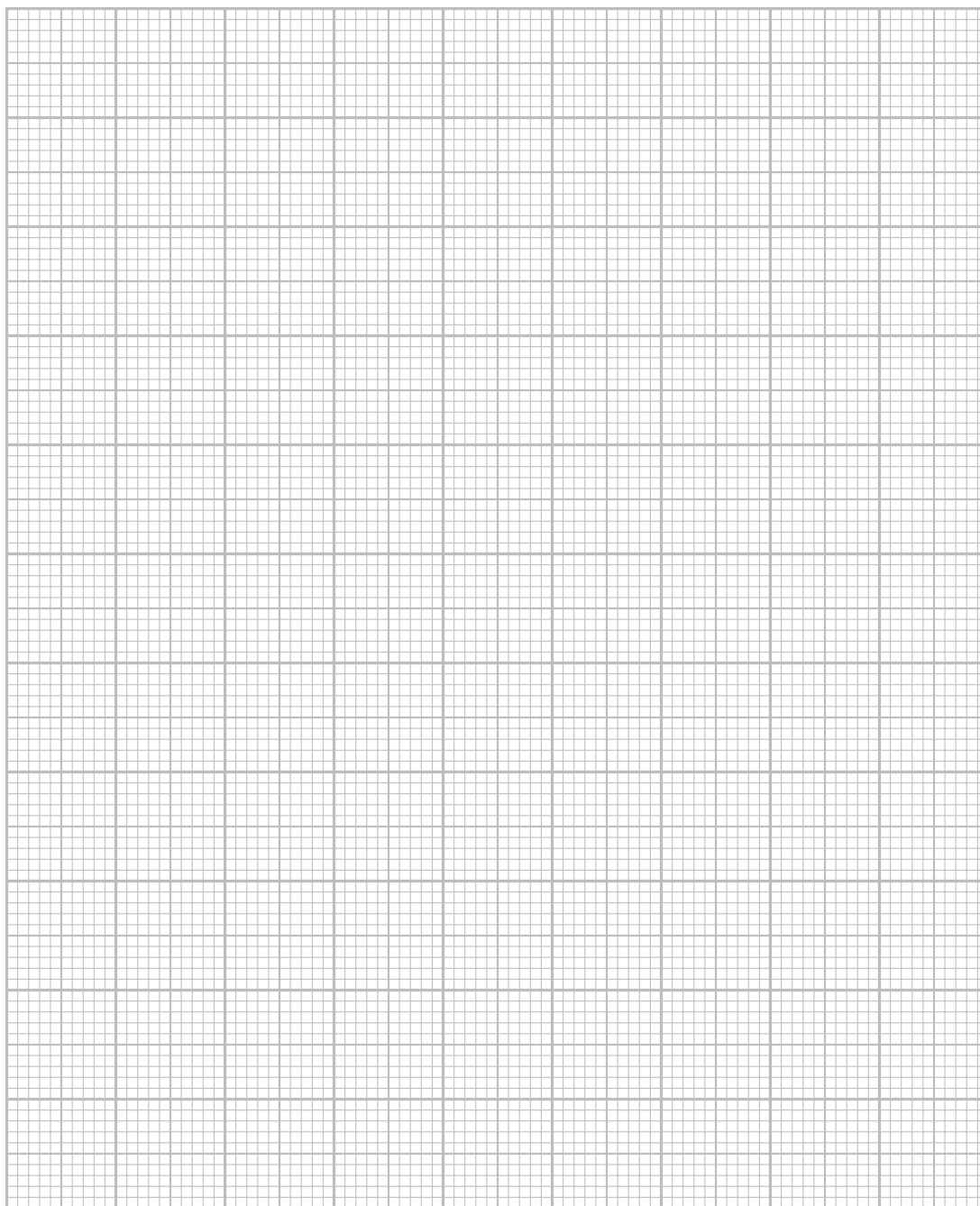
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



(a) Plot a graph of temperature against time on the grid.

(3)



(b) Determine the maximum temperature change, ΔT , using your graph.

You **must** show your working on the graph.

(2)

$\Delta T =$



(c) The value of the enthalpy change from this experiment was $-39.0 \text{ kJ mol}^{-1}$.

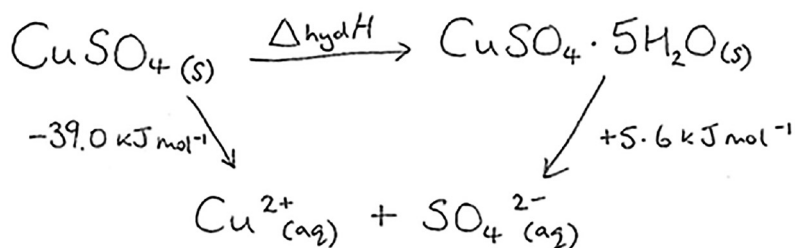
Give **one** possible reason why this value is different from a data book value of $-61.4 \text{ kJ mol}^{-1}$.

(1)

(d) After another experiment to find the enthalpy change of solution of hydrated copper(II) sulfate crystals, the student constructed the Hess cycle shown.

(i) Calculate the enthalpy change of hydration for the conversion of anhydrous copper(II) sulfate to hydrated copper(II) sulfate crystals.

(1)



(ii) Give **one** possible reason why the enthalpy change of hydration in (d)(i) could **not** be found directly by experiment.

(1)

(Total for Question 3 = 8 marks)



DO NOT WRITE IN THIS AREA

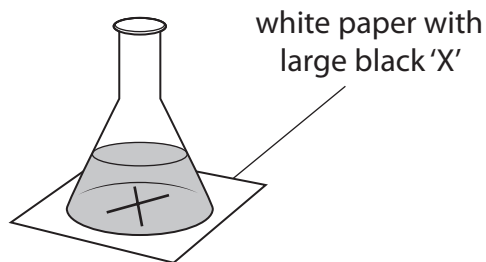
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

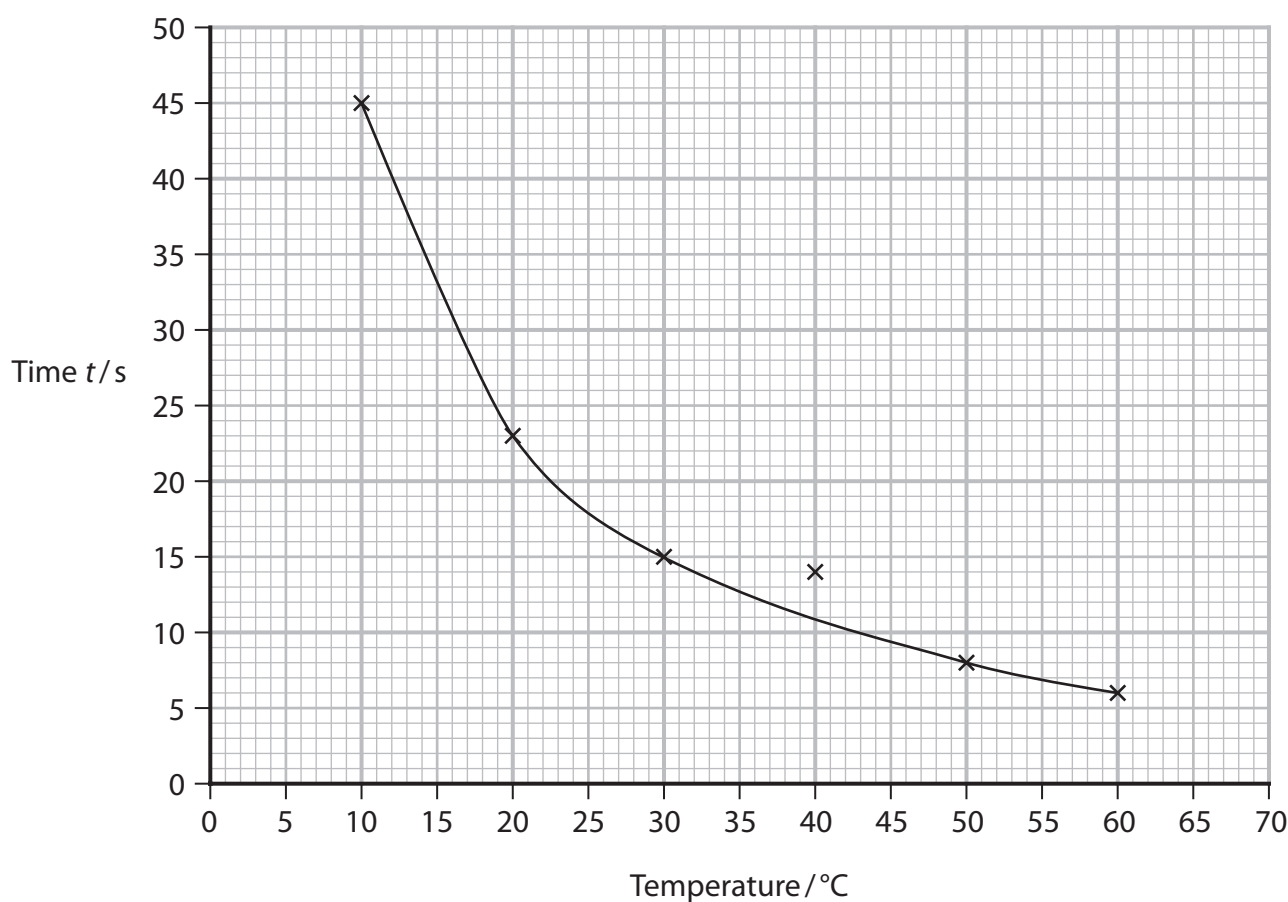
BLANK PAGE



- 4 Students were set a challenge by their teacher to produce a chemical clock measuring a 20 s time interval. They used an opaque solution that became transparent, allowing a black cross to become visible after 20 s.



The students investigated the effect of temperature on their results and plotted a graph.

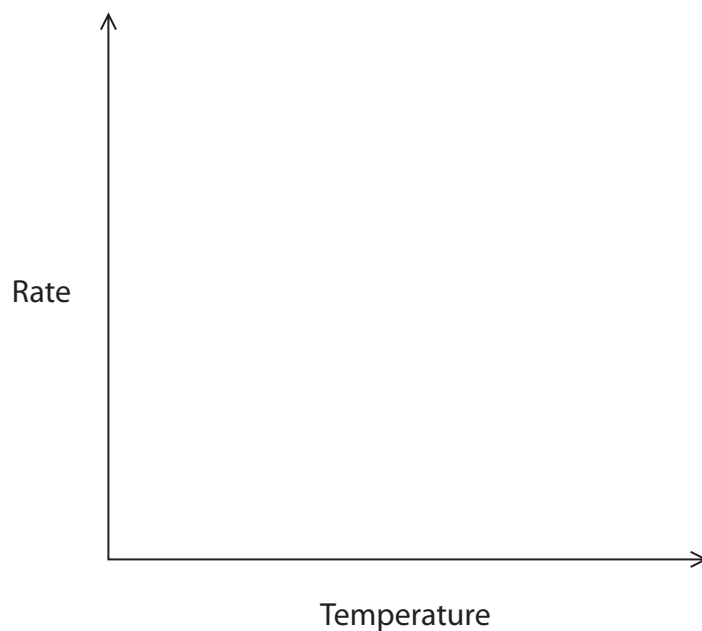


- (a) In this type of experiment $1/t$ (where t is time) may be used as a measure of the rate of reaction.
- (i) Calculate the rate at 15°C to a suitable number of significant figures. Include units in your answer.

(3)

- (ii) Sketch a line showing how the rate of reaction varies with temperature for this reaction.

(1)



- (b) Evaluate the students' results and decide whether it is necessary to repeat their experiments.

(2)

.....

.....

.....

.....

.....

- (c) State how you would change the conditions to make this chemical clock measure 40 s at 22 °C.

(1)

.....

.....

.....

.....

.....

(Total for Question 4 = 7 marks)



- 5 A technician found a bottle of sodium hydroxide solution at the back of a cupboard. The technician determined its concentration by titrating 25.0 cm^3 samples against 0.500 mol dm^{-3} hydrochloric acid from a burette.

The results obtained are shown.

- (a) Complete the titre values.

(1)

	Titration number				
	Rough	1	2	3	4
Final reading / cm^3	24.90	21.25	42.85	21.80	43.15
Initial reading / cm^3	2.30	0.00	21.25	0.50	21.80
Titre / cm^3					21.35

- (b) (i) State why the value from Titration 2 was **not** used to calculate the mean.

(1)

- (ii) Calculate the concentration of the sodium hydroxide solution in mol dm^{-3} .

(4)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



- (c) Each reading of the burette has an uncertainty of $\pm 0.05 \text{ cm}^3$.

Calculate the percentage uncertainty in Titration 4.

(1)

- (d) State the colour change that would be seen at the end-point in this titration using phenolphthalein as the indicator.

(2)

From to

(Total for Question 5 = 9 marks)

TOTAL FOR PAPER = 50 MARKS

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



The Periodic Table of Elements

1	2	1.0 H hydrogen 1						3	4	5	6	7	0 (8)		
(1)		(2)		Key											
				relative atomic mass atomic symbol name atomic (proton) number											
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		
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		
39.1	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		
85.5	Rb rubidium 37	87.6	Sr strontium 38	112.4	In indium 49	114.8	Sn tin 50	121.8	Sb antimony 51	127.6	Te tellurium 52	126.9	I iodine 53		
132.9	Cs caesium 55	137.3	Ba barium 56	200.6	Hg mercury 80	204.4	Tl thallium 81	207.2	Pb lead 82	209.0	Po polonium 84	[210]	At astatine 85		
[223]	Fr francium 87	[226]	Ra radium 88	[227]	Ac* actinium 89	[272]	Rg roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						[222]	Rn radon 86
* Lanthanide series															
* Actinide series															
140	Ce cerium 58	141	Pr praseodymium 59	144	Nd neodymium 60	150	Sm samarium 62	152	Eu europium 63	157	Gd gadolinium 64	163	Dy dysprosium 66		
												167	Er erbium 68		
												169	Tm thulium 69		
												173	Yb ytterbium 70		
												175	Lu lutetium 71		
232	Th thorium 90	[231]	Pa protactinium 91	238	U uranium 92	[242]	Pu plutonium 94	[243]	Am americium 95	[247]	Cm curium 96	[251]	Cf californium 98		
												[253]	Fm fermium 100		
												[254]	No nobelium 102		
												[255]	Lr lawrencium 103		