Centre No.					Pape	er Refer	ence			Surname	Initial(s)
Candidate No.			6	C	Н	0	1	/	1	Signature	

Paper Reference(s

6CH01/1 Edexcel GCE

Chemistry

Advanced Subsidiary

Unit 1: The Core Principles of Chemistry

Sample Assessment Material

Time: 1 hour 15 minutes

Materials required for examination	Items included with question paper
Nil	Nil

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initial(s) and signature. Check that you have the correct question paper.

Answer ALL the questions. Write your answers in the spaces provided in this question paper. Some questions must be answered with a cross in a box (\boxtimes) . If you change your mind, put a line through the box (\boxtimes) and then mark your new answer with a cross (\boxtimes) .

Do not use pencil. Use black or blue ink.

Information for Candidates

The marks for individual questions and the parts of questions are shown in round brackets: e.g. (2). There are 19 questions in this question paper. The total mark for this paper is 80. There are 28 pages in this question paper. Any blank pages are indicated. Candidates may use a calculator.

Advice to Candidates

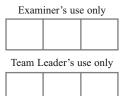
Quality of written communication will be taken into account in the marking of your responses to Questions 15(a), 16(d), 18(a)(iv), 18(b)(i) and 18(b)(ii). These questions are indicated with an asterisk. Quality of written communication includes clarity of expression, the structure and presentation of ideas and grammar, punctuation and spelling.

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Turn over

Total



			SECTION A	Leave blank
]	minu	ites (ALL the questions in this section. You should aim to spend no more than 25 on this section. For each question, select one answer from A to D and put a box (⋈). If you change your mind, put a line through the box (⋈) and then mark your new answer with a cross (⋈).	
			Use the Periodic Table as a source of data.	
1.	Go	ing a	across a period in the Periodic Table from left to right, the general trend is that	
	X	A	the bonding in the element itself changes from ionic to covalent	
	X	В	the number of neutrons in the nucleus increases	
	X	C	the first ionisation energy decreases	
	X	D	the metallic character increases	Q1
			(Total 1 mark)	
2.		ow,	ectron configurations of argon, iron, chlorine and one other element are given but not in order. Which one represents the unnamed element? $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6 4s^2$	
	X	В	$1s^2 2s^2 2p^6 3s^2 3p^6$	
	X	C	$1s^2 2s^2 2p^6 3s^2 3p^4$	
	X	D	$1s^2 2s^2 2p^6 3s^2 3p^5$	Q2
			(Total 1 mark)	
3.	its	stru	insterfullerene is a carbon molecule with formula C_{60} which can trap metal ions in eture. Which of the following compounds of buckminsterfullerene would give a mass/charge ratio at 837.3 in a mass spectrometer?	
	X	A	Na_4C_{60}	
	×	В	K_3C_{60}	
	X	C	Ca_3C_{60}	
	×	D	AgC_{60}	Q3
			(Total 1 mark)	

- **4.** This question is about the following equations:
 - A $Cu(NO_3)_2(s) \rightarrow CuO(s) + 2NO_2(g) + O_2(g)$
 - $\textbf{B} \quad 2HCl(aq) + CuO(s) \rightarrow H_2O(l) + CuCl_2(aq)$
 - C $C_4H_9OH(1) + 6O_2(g) \rightarrow 4CO_2(g) + 5H_2O(1)$
 - **D** $C_8H_{18}(1) + 8\frac{1}{2}O_2(g) \rightarrow 8CO(g) + 9H_2O(1)$
 - (a) Which equation is **not** balanced?
 - \times A
 - \mathbb{Z} B
 - \times C
 - \square D

(b) Which equation shows incomplete combustion?

- \mathbf{X} A
- \mathbf{X} **B**
- \mathbf{X} C
- \times D

(1)

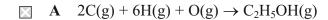
(1)

Q4

(Total 2 marks)

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

5. Which of the equations shown below represents the reaction for which ΔH is the standard enthalpy change of formation, $\Delta H_{\rm f\,298}^{\ominus}$, for ethanol, C₂H₅OH. Ethanol melts at 156 K and boils at 352 K.



$$\square$$
 C 2C(s) + 3H₂(g) + O(g) \rightarrow C₂H₅OH(g)

D 2C(s) + 3H₂(g) +
$$\frac{1}{2}$$
O₂(g) → C₂H₅OH(l)

Q5

(Total 1 mark)

6. Use the data about four fuels given below to answer this question.

Fuel	Formula	Name	Enthalpy change of combustion /kJ mol ⁻¹	Molar mass /g mol ⁻¹
A	CH ₄	methane	-890	16
В	CH ₃ OH	methanol	-726	32
С	C ₃ H ₈	propane	-2219	44
D	C ₄ H ₁₀	butane	-2877	58

(a) Which fuel, A, B, C or D, produces most energy per gram on complete combustion?

 \mathbf{X} A

 \mathbf{B}

 \mathbf{K} C

 \mathbf{X} **D**

(1)

- (b) Scientists give governments advice on technical issues. What information would scientists use when advising governments on the choice of one of these fuels, if the aim was to minimise carbon dioxide production?
- $oxed{\square}$ A mass of carbon per gram of fuel
- **B** mass of carbon per kilojoules produced
- C number of kilojoules produced per gram
- D number of kilojoules produced per mole

(1)

Q6

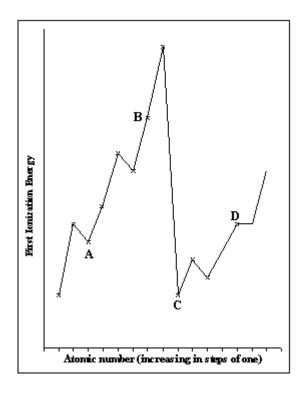
(Total 2 marks)

- 7. Which of the following equations represents the first ionisation of sulfur?
 - \triangle **A** $S(s) + e^- \rightarrow S^-(g)$
 - \square **B** $S(g) + e^- \rightarrow S^-(g)$
 - \square C $S(s) \rightarrow S^{+}(g) + e^{-}$
 - \square **D** $S(g) \rightarrow S^{+}(g) + e^{-}$

Q7

(Total 1 mark)

8. Which element marked on this graph is a halogen?



- \mathbf{X} A
- \boxtimes B
- **区 C**
- \mathbf{X} **D**

Q8

(Total 1 mark)

									Leav
9.				oout the fall in kJ r		ionisation	energy seque	ences.	
		A	1400	1000	950	830	700		
		В	420	3100	4400	5900	8000		
		C	1000	1250	1520	420	590		
				2700	3900	5800	7200		
		D	1520						
	Sele	ct fi	om A to	D the se	equence v	vhich is m	ost likely to	represent the following:	
							nsecutive me omic number	mbers of the same group in the c.	
	\times	A							
	X	В							
	X	C							
	X	D						(1)	
	(b)	The	first fiv	ve ionisat	ion energ	ies of an s	-block eleme	ent.	
	X	A							
	X	В							
	X	C							
	X	D							
								(1)	
	(c)	The	first fiv	ve ionisat	ion energ	ies of a no	ble gas.		
	X	A							
	X	В							
	×	C							
	X	D						(1)	00
								(1)	Q9

L	ea	ιV	'e
hl	a	n	k

- 10. Question 10 is about four hydrocarbons with molecular formulae as shown.
 - \mathbf{A} C_2H_2
 - \mathbf{B} C_3H_6
 - \mathbf{C} C_3H_8
 - **D** C_4H_{10}
 - (a) Which hydrocarbon has the same empirical formula as its molecular formula?
 - \boxtimes A
 - \boxtimes B
 - \mathbf{X} C
 - \boxtimes D

(1)

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

- (b) Which has a molecular ion in the mass spectrum at mass/charge ratio = 58?
- \mathbf{X} A
- \blacksquare B
- \mathbf{X} C
- \boxtimes **D**

(1)

		Leave blank
	Which is neither an alkane nor an alkene?	
×	\mathbf{A}	
×	В	
\boxtimes	C	
\boxtimes	D (1)	
(d)	Which could be 2-methylpropane?	
×	\mathbf{A}	
×	В	
\boxtimes	C	
×	D (1)	Q10
	(1)	Q10
	(Total 4 marks)	

11. Question 11 is about the following organic compounds with skeletal formulae as shown:

A /

В

C

D Br

(a) Which compound could be made from one of the others in an addition reaction?

 \boxtimes A

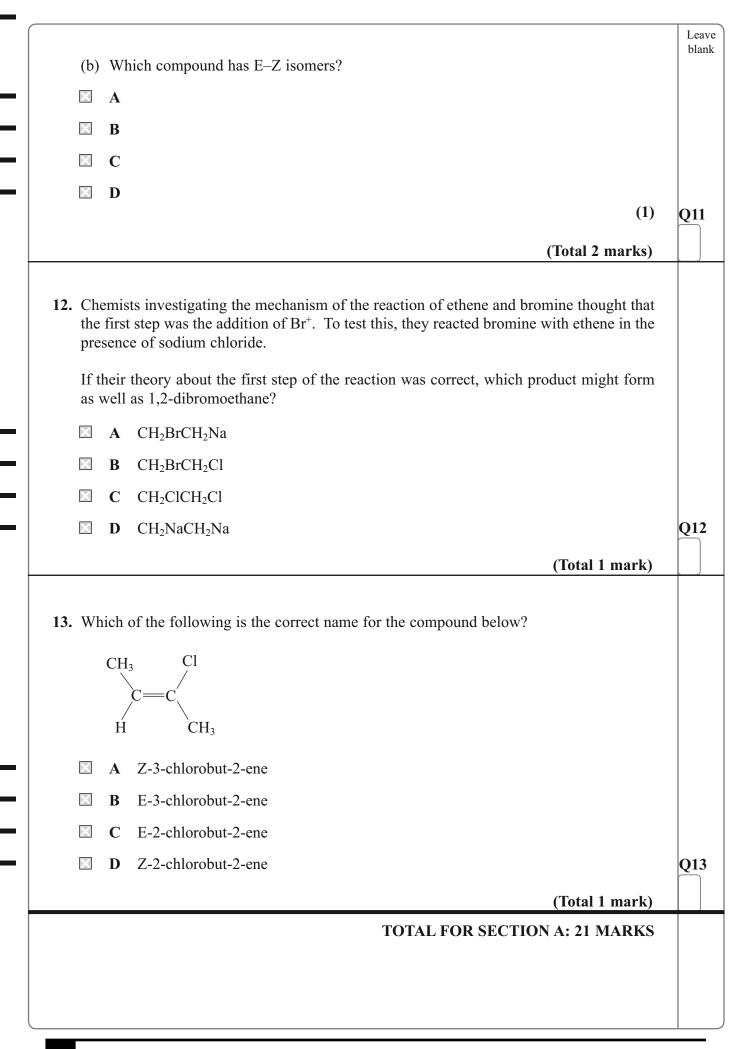
 \times B

 \mathbf{X} C

 \times D

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

(1)



SECTION B

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

- **14.** Copper(II) sulfate solution can be prepared from solid copper(II) carbonate by reaction with hot dilute sulfuric acid.
 - (a) Write the equation for the reaction, including state symbols.

(1)

(b) The experiment was carried out using 0.025 moles of sulfuric acid of concentration 2.0 mol dm⁻³. What volume of this sulfuric acid was used?

(1)

(c) (i) It is usual to react the sulfuric acid with a slight excess of copper(II) carbonate.

Calculate the mass of copper(II) carbonate needed if a 10% excess is required.

[Molar mass of copper(II) carbonate = 123.5 g mol⁻¹]

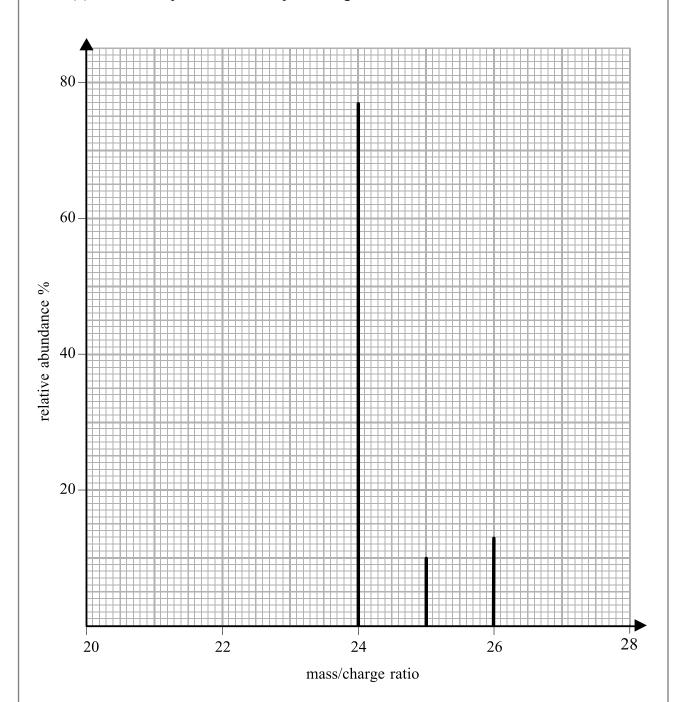
(2)

L	eave
h	lank

	ii) A student doing this experiment chose to use a balance reading to 0.01 g in an attempt to work accurately.
	Was this choice of balance necessary from the point of view of accuracy? Explain your answer.
	(1)
	The sulfuric acid is heated to boiling and the copper(II) carbonate is added in small ortions.
	tate the next step needed to prepare pure copper(II) sulfate solution. Justify your nswer.
,	(1)
	When the solution of copper(II) sulfate is allowed to crystallise, the crystals which are roduced have the formula $CuSO_4.5H_2O$.
(i) What is the molar mass of CuSO ₄ .5H ₂ O?
	(1)
((1) 3.98 g of CuSO₄.5H₂O crystals were obtained. Calculate the percentage yield in this experiment.
(ii) 3.98 g of CuSO ₄ .5H ₂ O crystals were obtained. Calculate the percentage yield in
(ii) 3.98 g of CuSO ₄ .5H ₂ O crystals were obtained. Calculate the percentage yield in

a)	Describe the bonding in magnesium and explain why it is a good concelectricity.	ductor of
		•••••
		•••••
		•••••
		(3)
b)	Draw a diagram (using dots or crosses) for the ions in magnesium fluoride all the electrons and the ionic charges on:	showing
	(i) the magnesium ion	
		(1)
	(ii) the fluoride ion.	
		(1)
c)	Under what conditions does magnesium fluoride conduct electricity?	
	Explain your answer.	
		••••••
		(1)
		(1)

(d) The mass spectrum of a sample of magnesium is shown below.



(i) Use the data above to estimate the percentage isotopic composition of the sample of magnesium. Hence calculate the average atomic mass of the sample of magnesium.

(2)

1.20 nanomol dm ⁻³ of chlorophyll, C ₅₅ H ₇₇ MgN ₄ O ₅ . (I nanomol = 1 × 10 ⁻⁹ mol) What mass of magnesium would be present in 1.00 cm ³ of this sample of seawater? Give your answer to three significant figures. (2) (ii) X-ray diffraction can be used to locate atoms or ions in molecules like chlorophyll. X-rays are scattered by the electrons in atoms and ions. In chlorophyll the atoms of one of the elements still cannot be located with certainty by this technique. Suggest which element is most difficult to locate.		
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(1)		
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16. Airbags, used as safety features in cars, contain sodium azide, NaN₃. An airbag requires a large volume of gas to be produced in a few milliseconds. The gas is produced in this reaction:

$$2\text{NaN}_3(s) \rightarrow 2\text{Na}(s) + 3\text{N}_2(g)$$
 ΔH is positive

When the airbag is fully inflated, 50 dm³ of nitrogen gas is produced.

(a) Calculate the number of molecules in 50 dm³ of nitrogen gas under these conditions.

[The Avogadro constant = 6.02×10^{23} mol⁻¹. The molar volume of nitrogen gas under the conditions in the airbag is 24 dm³ mol⁻¹].

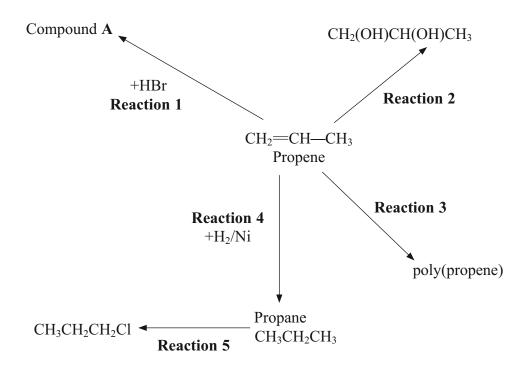
(2)

(b) Calculate the mass of sodium azide, NaN₃, that would produce 50 dm³ of nitrogen gas.

(3)

	(1)	
*(d)	The airbag must be strong enough not to burst in an accident. An airbag which has burst in an accident is hazardous if the sodium azide in it has decomposed.	
	Explain why this is so.	
	(2)	
	(Total 8 marks)	

17. Propene can be used to make other important chemical products. The processes involved can be summarised in the diagram:



(a) (i) Give the mechanism for **Reaction 1**.

(3)

Leave
blank

	(ii) Explain why compound A and not its structural isomer is the major product in Reaction 1 .
	(1
	(iii) Name compound A formed in Reaction 1.
	Name
(b)	What is added in Reaction 2 to make the product CH ₂ (OH)CH(OH)CH ₃ ?
	Complete the balanced equation for the formation of poly(propene) in Reaction using displayed formulae.
	$n(CH_2 = CHCH_3) \rightarrow$
	Poly(propene) fibres can be used to make fleece which is used at several horse racin courses to prevent the ground becoming frozen.
	State one advantage of using poly(propene) instead of natural fibres of similar cost
	(1

Leave blank	(e) (i) One stage in the mechanism of Reaction 5 is shown below.
	CH ₃ CH ₂ CH ₃ + Cl $^{\bullet}$ \rightarrow CH ₃ CH ₂ CH ₂ $^{\bullet}$ + HCl
	What is this step?
(1)	
nal mixture which	(ii) Give the name or formula of the trace product present in the gives evidence for this mechanism.
(1) Q17	
(Total 11 marks)	

18. A student investigated a reaction which could be used to warm up coffee in self-heating cans.

$$Mg(s) + Cu(NO_3)_2(aq) \rightarrow Mg(NO_3)_2(aq) + Cu(s)$$

In the self-heating cans, the bottom has a compartment containing copper(II) nitrate solution. When a button on the bottom of the can is pressed, the magnesium powder is released into the compartment where it reacts with the copper(II) nitrate solution.

(a) A student investigated the enthalpy change for this reaction by measuring

50.0 cm³ of 0.300 mol dm⁻³ copper(II) nitrate solution into a 100 cm³ beaker and adding 1 g (an excess) of magnesium powder.

The results are shown below.

Temperature of copper(II) nitrate solution at start = 22 °C Temperature of mixture after reaction = 43 °C

Leave
blank

(i)	Calculate the energy change which took place.	The specific heat capacity of the
	solution is $4.20 \text{ J g}^{-1}\text{K}^{-1}$.	

Which is the correct value for the energy change in joules?

(1)

(ii) How many moles of copper(II) nitrate were used in the experiment?

(1)

(iii) Calculate the enthalpy change for the reaction. You should include a sign and units in your answer.

(2)

L	ea	V	e
hl	laı	n	k

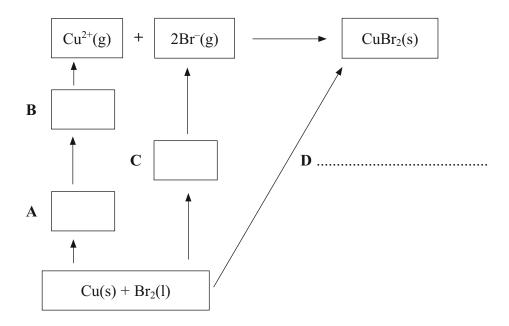
*(iv) Suggest two changes you would make to the equipment used in order to improve the accuracy of the result.
(2)
(b) The ionic equation for the reaction is shown below:
$Mg(s) + Cu^{2+}(aq) \rightarrow Mg^{2+}(aq) + Cu(s)$ $\Delta H = -532 \text{ kJ mol}^{-1}$
Would the following affect the value of the experimental result?
Explain your answer, stating the effect, if any, on the value of the enthalpy change obtained.
*(i) The student used 2 g rather than 1 g of magnesium.
(2)
*(ii) The heat losses that occurred from the student's beaker.
(2)

(c)	The temperature in the self-heating can needs to increase by 60 °C to produce a hot drink.	Leave blank
	Suggest a change you could make to the mixture in the experiment in (a) to produce a greater temperature rise. You are not expected to do a calculation.	
	(1)	Q18

19. The following data can be used in a Born-Haber cycle for copper(II) bromide, CuBr₂.

Enthalpy change of atomisation of bromine $\Delta H_{\text{at}}^{\ominus}[^{1/2}Br_{2(1)}]$	+111.9 kJ mol ⁻¹
Enthalpy change of atomisation of copper, $\Delta H^{\oplus}_{at}[Cu(s)]$	+338.3 kJ mol ⁻¹
First ionisation energy of copper, E_{m1} [Cu(g)]	$+746.0 \text{ kJ mol}^{-1}$
Second ionisation energy of copper, E_{m2} [Cu(g)]	+1958.0 kJ mol ⁻¹
Electron affinity of bromine, $E_{\text{aff}}[Br(g)]$	$-342.6 \text{ kJ mol}^{-1}$
Enthalpy change of formation of CuBr ₂ (s), $\Delta H_{\rm f}^{\oplus}$ [CuBr ₂ (s)]	$-141.8 \text{ kJ mol}^{-1}$

(a) On the following outline of a Born-Haber cycle complete the boxes **A**, **B**, and **C** by putting in the formula and state symbol for the appropriate species and writing the name of the enthalpy change **D**.

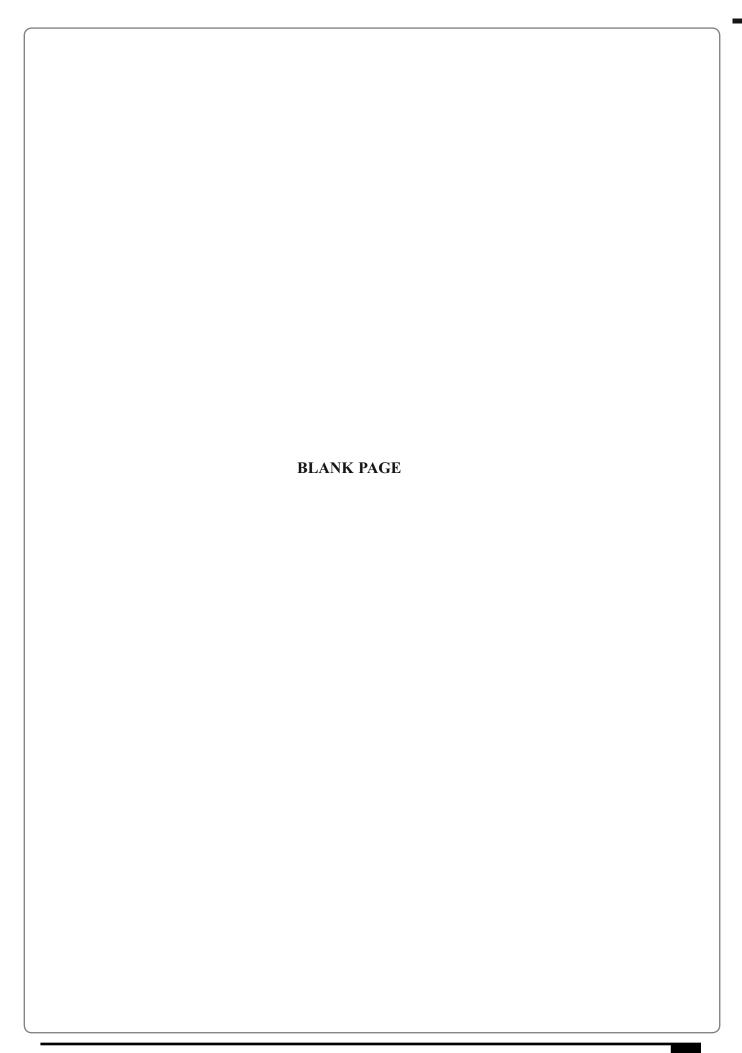


(3)

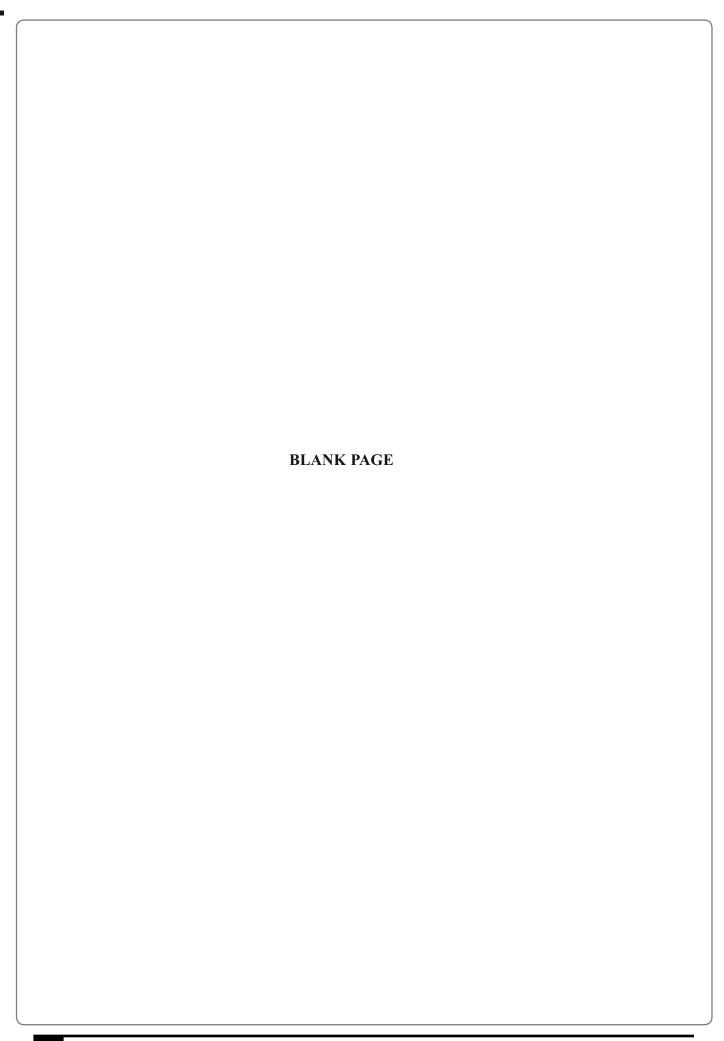
(Total 11 marks)

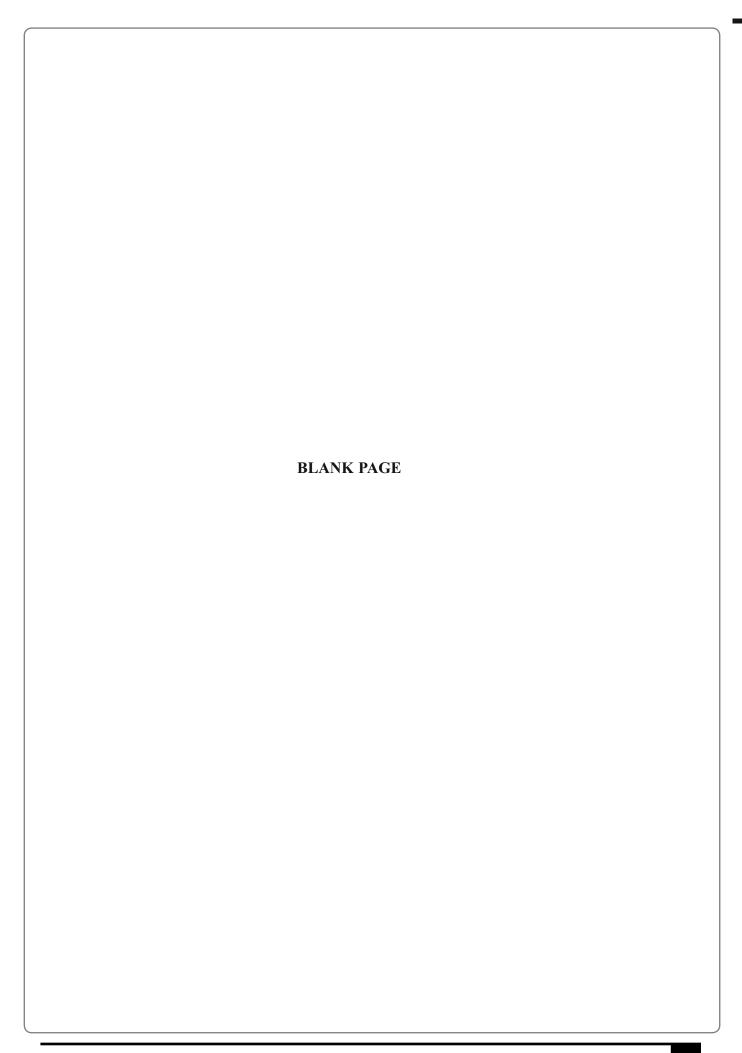
blank	Use the data to calculate a value for the lattice energy of copper(II) bromide.	(b)
	Give a sign and units in your answer.	
	(3)	
	When the lattice energy of copper(II) bromide is calculated from ionic radii and charges, the result is a value numerically about 10% less than the one obtained from the Born-Haber cycle.	(c)
	(i) What does this suggest about the nature of the bonding in copper(II) bromide?	
	(1)	
	(ii) Draw a diagram to show how the smaller copper ion alters the shape of the larger bromide ion.	
Q19	(1)	
	(Total 8 marks)	
	TOTAL FOR SECTION B: 59 MARKS TOTAL FOR PAPER: 80 MARKS END	

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39.1	40.1	45.0	47.9	50.9	52.0	54.9	55.8	58.9	58.7	63.5	65.4	69.7	72.6	74.9	79.0	79.9	83.8
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132.9	137.3	138.9	178.5	180.9	183.8	186.2	190.2	192.2	195.1	197.0	200.6	204.4	207.2	209.0	[509]	[210]	[222]
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caesium 55	barium 56	lathanum 57	hafnium 72	tantalum 73	tungsten 74	rhenium 75	osmium 76	indium 77	platinum 78	gold 79	mercury 80	thallium 81	lead 82	bismuth 83	polonium 84	astatine 85	radon 86
[223]	[526]	[227]	[261]	[292]	[596]	[564]	[277]	[368]	[271]	[272]							
ት	Ra		¥		Sg					Rg	Elem	Elements with atomic numbers 112-116 have been reported	atomic nur	mbers 112-	116 have b	seen report	pa
francium 87	radium 88	actinium 89	rutherfordium 104	dubnium 105	seaborgium 106	bohrium 107	hassium 108	meitnerium 109	darmstadtium n 110	roentgenium 111			but not fi	but not fully authenticated	iticated		
			140	141	144	[147]	150	152	157	159	163	165	167	169	173	175	
* Lantha	* Lanthanide series	S	e e	P	P	_E	Sm	П	В		2		ы	Ę	χP	3	
* Actinio	* Actinide series		_	praseodymium	praseodymium neodymium promethium	promethium	Sa	Ε	gadolinium	F	dysprosium	걸	erbium	thulium	ytterbium	lutetium	
	20.00		58	59	09	61	62	63	64	65	99	- 67	89	69	70	71	
			232	[231]	ı	[237]	[242]	[243]		[245]	_	[254]	[253]	[526]	[254]	[257]	
				Pa	>	S.	Np Pu Am	Αm		<u></u>	ຽ	S :		ΡW	S.	ے د	
			mnioni 00	protactinium 91	uranıum 92	neptunium 93	ptutonnum 94	amencium 95	mun %	Derkeuum 97	catifornium einsteinium 08 00	einsteinium	100	mendelevium 101	nobelium 102	lawrencium 103	
			2	٦		5	ţ	S	- 1	,	20	,	3	2	701	2	