

GCE

Chemistry B (Salters)

Mark Scheme

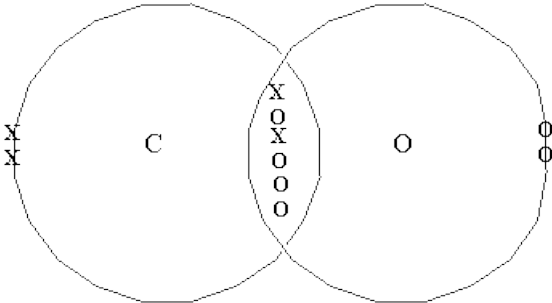
Question			Answer	Marks	Guidance
1	(a)	(i)	methanol ✓	1	methan-1-ol does not score, and if with methanol is a CON 'spelling must be unambiguous'
		(ii)	alkene(s) ✓	1	IGNORE any references to branching cycloalkene is a CON
		(iii)	Skeletal (formula) ✓	1	ALLOW 'mis-spellings if meaning is clear' NOT skeleton
	(b)	(i)	C ₄ H ₈ ✓	1	ALLOW reversed
		(ii)	fractional distillation ✓	1	NOT distillation on own ALLOW 'fractionation' ALLOW mis-spellings if meaning is clear
		(iii)	C ₁₂ H ₂₆ → C ₄ H ₈ + C ₈ H ₁₈ ✓	1	No ECF from wrong formula in (b)(i) ALLOW structural formulae
		(iv)	Reactants/molecules/substances adsorbed on catalyst (surface) ✓ bonds (with)in/intramolecular bonds in <u>reactants</u> (weaken and) break ✓ new bonds form OR bonds form in products ✓ product/new molecules desorb/diffuse off/leave catalyst (surface) ✓	4	QWC: Adsorbed/adsorption/adsorb SPG ; must be spelled correctly to score first marking point, but does not score on own. 'Their bonds' AW is ok if reactants have been mentioned in first marking point NOT 'bonds between reactants break' Any reference to new bonds forming IGNORE comments about catalyst surface providing reaction route of lower E _a or explanation of heterogeneous
	(c)	(i)	C ₅ H ₁₂ O(l) + 7½O ₂ (g) → 5CO ₂ (g) + 6H ₂ O(l) ✓	1	DO NOT ALLOW multiples etc (question asks per mole burnt) ALLOW 7.5 OR 15/2

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1	(c)	(ii)	burns <u>more</u> completely / <u>more</u> complete combustion / <u>less</u> incomplete combustion ✓ already partially/slightly oxidised/contains an O (atom) in molecule OR pentane only has C and H (atoms)/no O atoms ✓	2	Assume answer refers to MTBE unless otherwise stated. Must be comparative statement to score first mark IGNORE ideas about CO being formed then further oxidised IGNORE 'clean burning' IGNORE MTBE is an oxygenate IGNORE reference to number of moles of oxygen needed by pentane/MTBE CON O ₂ or 'oxygen molecule'
		(iii)	nitrogen AND carbon dioxide ✓	1	both needed ALLOW correct formulae (with upper case – BOD if unclear) IGNORE formulae if names present
	(d)	(i)	wedges: bonds in front of plane of paper and dashed line: bonds behind ✓	1	any indication that wedge sticks out and dashed goes in scores this mark
		(ii)	(molecules with) same molecular formula but different structural formula/arrangement of atoms ✓ (MTBE and ETBE) do not have same molecular formula ✓	2	NOT '(chemical) formula' ALLOW 'same number of each atom' or 'same number and types of atoms' ALLOW different arrangement (of atoms) ALLOW different skeletal formulae ALLOW 'do not have same <u>number</u> of atoms' OR answer in terms of 'more C or H' If formulae are written they must be correct or this will CON second mark
	(e)		comes from crops which can be re-grown/AW ✓ plants take in/absorb/use CO ₂ for photosynthesis/growth ✓ (roughly) balances out CO ₂ produced on burning ✓	3	vital word is 'grow/growing/growth' etc in the context that they can be replenished NOT just 'while living' To score both points 2 and 3, CO ₂ must be mentioned or implied in both the answers If no reference to idea of balance maximum total mark is 2 IGNORE references to C or CO
			Total	20	

Question			Answer	Marks	Guidance
2	(a)		$\text{Mg}(\text{OH})_2(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow \text{MgCl}_2(\text{aq}) + 2\text{H}_2\text{O}(\text{l})$ formulae and balancing ✓ state symbols (ss) ✓	2	ALLOW multiples etc Award ss mark alone for unbalanced equation with the correct formulae and correct ss or balanced equation but incorrect formulae for Mg hydroxide and chloride but correct ss
	(b)	(i)	less heat transfer to surroundings (in polystyrene cup) ✓	1	ALLOW better (thermal) insulator / reduces heat loss / minimise heat loss ALLOW 'less heat absorbed by/lost to cup' / worse conductor Answer must be comparative IGNORE safety points eg broken glass
		(ii)	Mark any two from those below: ✓✓ <ul style="list-style-type: none">• (specific) heat capacity of HCl/solution same as water / 4.18• mass of water same as mass of HCl/solution• negligible/little/no heat loss to surroundings• volume of solution = mass of solution OR density of solution is 1 g cm^{-3} / same as water	2	IGNORE 'specific heat capacity of water is 4.18'. 4.2 is incorrect IGNORE references to volume changes/evaporation IGNORE 'all solid reacts' IGNORE references to Joules IGNORE reference to standard conditions
	(c)		more <u>hydroxide ions</u> in (a mole of) aluminium hydroxide OR more/three <u>hydroxide ions</u> (per mole) ORA ✓	1	Assume 'it' refers to one mole of aluminium hydroxide ALLOW '(aluminium hydroxide) requires three moles HCl' ALLOW OH^- groups but not OH^- molecules ALLOW OH^- / 'OH ions' instead of hydroxide ions DO NOT ALLOW 'higher concentration' of hydroxide ions IGNORE references to alkalinity, bases

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2	(d)	(i)	<p>molar mass of $\text{MgCO}_3 = 84.3 \checkmark$</p> <p>moles of $\text{MgCO}_3 = 0.2 \div 84.3 = 0.00237(2) / 0.0024 \checkmark$ (dividing 0.2 by a number and working out answer correctly)</p> <p>volume = $0.0024 \times 24000 = 57 \text{ cm}^3 \checkmark$ (multiplying some calculated number by 24000 and working out answer correctly)</p>	3	<p>ALLOW 84</p> <p>ALLOW two or more sf's NB If 84 used ALLOW 57.14(...) must not be rounded to fewer than 2sf</p> <p>NB 56.88 or 56.9(...) or 57 or 57.14(...) or 57.6 or 58 on answer line scores all three marks</p>
		(ii)	<p>measure of disorder/chaos/number of 'ways of arranging' \checkmark</p> <p>gas on product side/formed have <u>more</u> disorder/ways of arrangement/chaos OR gases formed have greater entropy (than solid/liquids) \checkmark</p>	2	<p>Just 'how particles can be arranged' too vague DO NOT ALLOW 'ways of arranging atoms' or 'ways <u>a</u> molecule can be arranged' or 'disorder of atoms' ALLOW 'ways of arranging a compound/substance'</p> <p>Must be implication that gas is a product</p> <p>NOT just 'increased entropy' (in stem) ALLOW more chemical species/substances/products on product side but NOT more moles/particles on RHS</p>
			Total	11	

Question			Answer	Marks	Guidance																													
3	(a)		in the same group as carbon / same number of outer electrons / can form four covalent bonds ✓	1	If 'below' is used it must be directly below Wrong group no. or number of electrons/bonds CON																													
	(b)		<table><tr><th rowspan="2">Substance</th><th colspan="2">Type of structure</th><th colspan="2">Melting point</th></tr><tr><th>Simple molecular</th><th>Covalent network</th><th>High</th><th>Low</th></tr><tr><td>C (diamond)</td><td></td><td>✓</td><td>✓</td><td></td></tr><tr><td>silicon</td><td></td><td>✓</td><td>✓</td><td></td></tr><tr><td>CO₂</td><td>✓</td><td></td><td></td><td>✓</td></tr><tr><td>SiO₂</td><td></td><td>✓</td><td>✓</td><td></td></tr></table>	Substance	Type of structure		Melting point		Simple molecular	Covalent network	High	Low	C (diamond)		✓	✓		silicon		✓	✓		CO ₂	✓			✓	SiO ₂		✓	✓		1	ALLOW other symbols eg x's
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	(c)	(i)	linear / 180 (°) ✓ two set of electrons/regions of negative charge around carbon/central atom ✓ repel as far as possible/minimise electron repulsion ✓	3	IGNORE straight or planar MUST mention electrons or negative centres/regions somewhere to be able to gain third mp IGNORE 'repel as much as possible'																													
		(ii)	dative/co-ordinate (covalent) ✓	1																														

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3	(c)	(iii)	 <p>lone pairs ✓ correct six electrons in shared area (need NOT have circles) ✓</p>	2	<p>Check there are two C electrons and four O electrons matching lone pair symbols. Ignore arrow.</p> <p>IGNORE any brackets around symbols</p> <p>ALLOW central electrons in any order or arrangement</p>
	(d)	(i)	${}^{14}_6\text{C} \rightarrow {}^{14}_7\text{N} + {}^0_{-1}\text{e}$ <p>one mark for correct beta particle on right hand side ✓</p> ${}^{14}_6\text{C} \rightarrow {}^{14}_7\text{N} \quad \checkmark$	2	<p>ALLOW: – (minus) beta particle on left hand side of equation</p> <p>DO NOT ALLOW e^-</p> <p>ALLOW β symbol instead of e</p> <p>Numbers on right of symbols scores one mark if all correct</p>
		(ii)	<p>3 half-lives elapsed ✓</p> <p>$3 \times 6000 = 18,000$ years ✓</p>	2	<p>100>50>25>12.5 scores first marking point</p> <p>ALLOW ecf from clearly stated number of half-lives</p> <p>both marks scored if 18,000 on answer line</p>
		(iii)	<p>Mark any two from those below: ✓✓</p> <ul style="list-style-type: none"> half-life unaffected by temp/pressure; no <u>loss</u> OR <u>gain</u> of radioisotope/C-14/C-12/C/organic material; all count rate comes from carbon-14; amount of carbon-14/count (rate) in living material today is the same as when organism died; levels of C14 in <u>atmosphere</u> have remained constant. 	2	<p>IGNORE 'rate of decay constant'</p> <p>IGNORE 'daughter' product</p> <p>ALLOW 'changed by metamorphic events'</p> <p>ALLOW the last ice age was less than 50,000 years ago</p>
			Total	14	

Question			Answer	Marks	Guidance
4	(a)	(i)	protons 38 electrons 38 neutrons 50	1	
		(ii)	$(84 \times 0.560) + (86 \times 9.86) + (87 \times 7.02) + (88 \times 82.56) \checkmark$ $\div 100 = 87.7102 \checkmark$ $= 87.7$ to 3 sig figs \checkmark	3	IGNORE any units given Any number to 3 sf from a <u>correctly evaluated</u> calculation scores sf mark 87.7 on answer line scores all three and 87.71(02) scores two marks
	(b)		2+	1	must show charge; ALLOW +2; ALLOW complete species eg Sr^{2+} ALLOW words
	(c)		Any two of: $\checkmark\checkmark$ <ul style="list-style-type: none"> <u>Gas</u>/hydrogen/H_2 given off/fizzing/bubbling/effervescence goes cloudy/white/milky ppt or solid gets warm/exothermic calcium dissolves / disappears 	2	If list mark first two and IGNORE the rest CON first point mention of any gas other than hydrogen Wrong substance as a precipitate is a CON on 2 nd point DO NOT ALLOW 'H' IGNORE equations
	(d)	(i)	$\text{SrCO}_3 \rightarrow \text{SrO} + \text{CO}_2 \checkmark$	1	'Heat' in equation is CON (ignore if on arrow) Any wrong symbol scores zero IGNORE state symbols

Question			Answer	Marks	Guidance
4		(ii)	Bubble gases through <u>lime water/calcium hydroxide solution/</u> <u>correct formula</u> ✓ lime water cloudy/white/milky/ppt forms ✓ longer time or slower (to give gas) has greater (thermal) <u>stability</u> ora ✓ strontium (carbonate) has greater (thermal) stability ora ✓	4	<i>First mark for a viable technique</i> (Heat samples and) collect gas in syringe etc. or measure (loss of) mass ✓ Production of gas / change of mass or volume is found ✓ Final two marking points as on left Must be a 'time element' eg rate of gas production <i>Question requires a general answer so IGNORE</i> <i>references to amount/mass/volume etc of chemicals</i>
	(e)	(i)	(relative) abundance ✓	1	IGNORE qualification ALLOW amount/concentration/'how much'/percentage NOT 'percentage <u>intensity</u> ' IGNORE mass of isotope
		(ii)	$\text{H}_2\text{O}^+/\text{H}_2^{16}\text{O}^+$ ✓	1	No alternatives
		(iii)	O-18 (isotope in water molecule) ✓	1	ALLOW D_2O or O-20 or THO or $\text{H}_3^{17}\text{O}^+$ ALLOW O with 12 neutrons
			Total	15	