

GCE

Chemistry B (Salters)

H033/01: Foundations of chemistry

Advanced Subsidiary GCE

2021 Mark Scheme (DRAFT)

This is a DRAFT mark scheme. It has not been used for marking as this paper did not receive any entries in the series it was scheduled for. It is therefore possible that not all valid approaches to a question may be captured in this version. You should give credit to such responses when marking learner's work.

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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1. Annotations

Annotation	Meaning
	Correct response
	Incorrect response
	Omission mark
	Benefit of doubt given
	Contradiction
	Rounding error
	Error in number of significant figures
	Error carried forward
	Level 1
	Level 2
	Level 3
	Benefit of doubt not given
	Noted but no credit given
	Ignore

2. Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

Annotation	Meaning
/	alternative and acceptable answers for the same marking point
✓	Separates marking points
DO NOT ALLOW	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
()	Words which are not essential to gain credit
—	Underlined words must be present in answer to score a mark
ECF	Error carried forward
AW	Alternative wording
ORA	Or reverse argument

3. Subject-specific Marking Instructions

INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

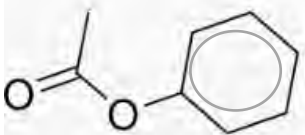
Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

Answers to Section A

Question	Key	AO
1	A	1.2
2	B	1.1
3	C	1.1
4	C	1.1
5	C	2.1
6	C	2.1
7	D	2.5
8	C	2.5
9	B	1.2
10	C	1.2
11	D	2.1
12	B	1.1
13	C	1.1
14	B	1.1
15	C	1.1
16	A	2.6
17	C	2.2
18	B	2.1
19	D	2.6
20	A	1.1

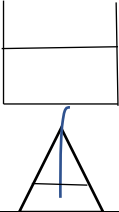
SECTION B

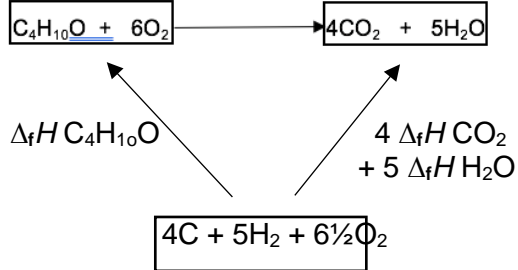
Question			Answer	Marks	AO element	Guidance
21	(a)	(i)	Group 2/Same group/ same number of outer-shell electrons ✓	1	1.1	
		(ii)	greater and (outer shell) electrons closer to nucleus ✓	1	2.2	
		(iii)	Ba(s) + 2H ₂ O(l) → Ba(OH) ₂ (aq/s) + H ₂ (g) Formation of Ba(OH) ₂ plus H ₂ ✓ Correct balancing and ss ✓	2	1.2 2.2	ALLOW BaO for this mark only
	(b)	(i)	136.2 and 233.4 ✓	1	1.1	
	(b)	(ii)	(Identifies/test for) sulfate (ion) ✓ Add solution of barium ions/ Ba ²⁺ / barium chloride/ barium nitrate AND White ppt/solid. ✓	2	2x 2.7	
	(c)		(Correct): Ba ²⁺ is larger than Ca ²⁺ ✓ (Incorrect) BaCO ₃ decomposes more readily/ higher thermal stability ✓ (Correct Chemistry): Ba ²⁺ has smaller charge density/larger size:charge ratio ✓ Distorts/polarises carbonate ion less ✓	4	4 x 3.1	ALLOW 'ORA' throughout IGNORE references to Ba ²⁺ attraction to CO ₃ ²⁻
			Total	11		

Question			Answer	Marks	AO element	Guidance
22	(a)	(i)	 ✓	1	1.2	
		(ii)	amount phenol (= 15/94) = 0.16 (mol) amount ethanoic anhydride (= 24/102) = 0.24 (mol) both amounts correctly calculated ✓ Correct conclusion from shown calculations as to which is in excess ✓	2	2.8 3.2	
	(b)		(fractional) distillation ✓	1	1.2	
	(c)		$^{13}\text{CC}_5\text{H}_5\text{OH}^+$ / $^{13}\text{CC}_5\text{H}_6\text{O}^+$ ✓✓ for completely correct ✓ if + sign omitted or ^{13}C shown but it is not clear there's only one. (not both)	2	2 x 1.2	
	(d)		ethanoic acid/ CH_3COOH ✓ C=O and 1700 or '1700 – 1725' ✓ O-H and 'around 3000'/2500-3300 ✓	3	3.2 3.1 3.1	
Total				9		

Question		Answer	Marks	AO element	Guidance															
23	(a)	Bright/coloured lines on a dark/black background ✓ Electrons in energy levels ✓ (Electrons) fall (to lower levels) ✓ Emit light/ radiation/ photon ✓ Frequency <u>proportional</u> to energy change/ $\Delta E = hv$ ✓	5	5 x 1.2	ALLOW 'shells' Electrons must be mentioned somewhere to score MP2 ALLOW $E = hv$ if energy change implied or 'energy of photon'.															
	(b)	(i) FIRST CHECK ANSWER LINE If answer = 5.10×10^{14} award 3 marks Use of $v = c/\lambda$ ✓ (= $3 \times 10^8 / 588 \times 10^{-9}$) = 5.10×10^{14} (Hz) (to any sf) ✓ 3 sf ✓	3	3 x 2.2	The result of any calculation to 3 sf scores MP3															
		(ii) E (= $hv = 6.63 \times 10^{-34} \times 5.00 \times 10^{14}$) = 3.32×10^{-19} ✓ Units ($J \text{ Hz}^{-1} \times \text{Hz}$) = J ✓	2	2 x 2.2	ALLOW 2 or more sf Mark number and units separately.															
		(iii) IR/infrared/ radio waves ✓	1	1.1	ALLOW microwave															
	(c)	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th></th> <th>He-3</th> <th>He-4</th> </tr> </thead> <tbody> <tr> <td>atomic number</td> <td>2</td> <td>2</td> </tr> <tr> <td>number of electrons</td> <td>2</td> <td>2</td> </tr> <tr> <td>number of neutrons</td> <td>1</td> <td>2</td> </tr> <tr> <td>mass number</td> <td>3</td> <td>4</td> </tr> </tbody> </table> <p>one mark for each column ✓✓</p>		He-3	He-4	atomic number	2	2	number of electrons	2	2	number of neutrons	1	2	mass number	3	4	2	2 x 1.1	
	He-3	He-4																		
atomic number	2	2																		
number of electrons	2	2																		
number of neutrons	1	2																		
mass number	3	4																		

	(d)	(i)	CHECK ANSWER LINE If answer = 47.92, award 2 marks $((46 \times 8.25) + (47 \times 7.44) + (48 \times 73.72) + (49 \times 5.41) + (50 \times 5.18))/100$ OR $(379.50 + 349.68 + 3538.56 + 265.09 + 259.00)/100$ ✓ = 47.92 ✓	2	2 x 2.5	
		(ii)	$3p^64s^24d^2/3p^64d^24s^2$ ✓	1	1.1	DO NOT ALLOW capital 'D' or subscript numbers
			Total	16		

Question			Answer	Marks	AO element	Guidance
24	(a)	(i)	Less CO/carbon monoxide (with high weight) ✓ CO is toxic/ poisonous ✓	2	2 x 1.1	IGNORE harmful
	(a)	(ii)	nitrogen and oxygen from the air ✓ combine/react in the heat of the engine ✓	2	2 x 1.2	
	(b)	(i)	Beaker placed above lamp ✓ With 'water line' shown and either 'beaker (of water)' or water labelled. ✓ 	2	2 x 3.3	
		(ii)	CHECK ANSWER LINE If answer = -1300/1290/1286 (kJ mol⁻¹) award 3 marks (Energy = 200 x 4.18 x 52/100) = 43.47 kJ ✓ Amount butan-1-ol (= 2.5/74) = 0.0338 mol ✓ Ans (= 43.47 / 0.0338) = -1286/1294/1300 kJ mol ⁻¹ ✓	3	3 x 2.4	ALLOW 2 or more sf Conversion to kJ can be at any stage Sign must be correct for MP3

	(c)	<p>(i)</p>  <p>Hess cycle (element box and arrows) ✓ $\Delta_c H = (4 \times -394) + (5 \times -286) + 327 = -2679 \text{ (kJ mol}^{-1}\text{)}$ ✓</p>	2	2 x 2.6	IGNORE state symbols
		<p>(ii)</p> <p>One from:</p> <ul style="list-style-type: none"> • heat losses • evaporation from wick • conditions not standard 	1	3.4	ALLOW incomplete combustion
	(d)	$\text{C}_4\text{H}_9\text{OCOCH}_3 \checkmark + \text{H}_2\text{O} \checkmark$	2	2 x 2.3	ALLOW any unambiguous formula for ester DO NOT ALLOW C4H9COOCH3
			14		

OCR (Oxford Cambridge and RSA Examinations)
The Triangle Building
Shaftesbury Road
Cambridge
CB2 8EA

OCR Customer Contact Centre

Education and Learning

Telephone: 01223 553998

Facsimile: 01223 552627

Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

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