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.

1. **Annotations**

Annotation	Meaning
	Correct response
	Incorrect response
	Omission mark
BOD	Benefit of doubt given
CON	Contradiction
RE	Rounding error
SF	Error in number of significant figures
ECF	Error carried forward
L1	Level 1
L2	Level 2
L3	Level 3
NBOD	Benefit of doubt not given
SEEN	Noted but no credit given
I	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**.

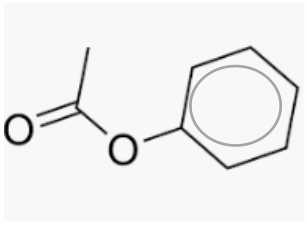
Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

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)	$Ba(s) + 2H_2O(l) \rightarrow Ba(OH)_2(aq/s) + H_2(g)$ 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		

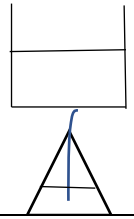
Question			Answer	Marks	AO element	Guidance
22	(a)	(i)	 ✓	1	1.2	
		(ii)	amount phenol (= 15/94) = 0.16 (mol) amount ethanoic anhydride (= 24/102) = 0.24 (mol) both amounts correctly calculated ✓ Correct conclusion from shown calculations as to which is in excess ✓	2	 2.8 3.2	
	(b)		(fractional) distillation ✓	1	1.2	
	(c)		$^{13}CC_5H_5OH^+$/ $^{13}CC_5H_6O^+$ ✓✓ 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		

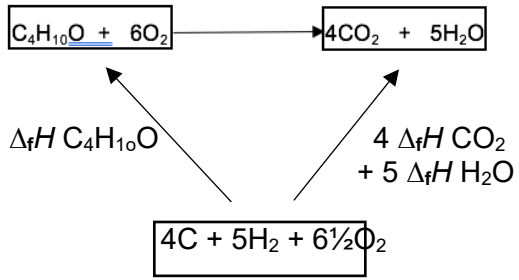
<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>23</td><td>(a)</td><td></td><td>Bright/coloured lines on a dark/black background ✓
Electrons in energy levels ✓
(Electrons) fall (to lower levels)✓
Emit light/ radiation/ photon ✓
Frequency <u>proportional</u> to energy change/ $\Delta E = hv$ ✓</td><td>5</td><td>5 x 1.2</td><td>
ALLOW ‘shells’
Electrons must be mentioned somewhere to score MP2
ALLOW E = hv if energy change implied or ‘energy of photon’.</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>FIRST CHECK ANSWER LINE
If answer = 5.10 x 10^{14} award 3 marks

Use of $v = c/\lambda$ ✓
(= 3 x 10^{8}/ 588 x 10^{-9})
= 5.10 x 10^{14} (Hz) (to any sf) ✓ 3 sf ✓</td><td>3</td><td>3 x 2.2</td><td>

The result of any calculation to 3 sf scores MP3</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>E (= hv = 6.63 x 10^{-34} x 5.00 x 10^{14})
= 3.32 x 10^{-19} ✓
Units (J Hz^{-1} x Hz) = J ✓</td><td>2</td><td>2 x 2.2</td><td>ALLOW 2 or more sf
Mark number and units separately.</td></tr>
<tr><td></td><td></td><td>(iii)</td><td>IR/infrared/ radio waves ✓</td><td>1</td><td>1.1</td><td>ALLOW microwave</td></tr>
<tr><td></td><td>(c)</td><td></td><td><table><tr><th></th><th>He-3</th><th>He-4</th></tr><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></table>one mark for each column ✓✓</td><td>2</td><td>2 x 1.1</td><td></td></tr>
</table>

	(d)	**(i)**	**CHECK ANSWER LINE** **If answer = 47.92, award 2 marks** ((46 x 8.25) + (47 x 7.44) + (48 x 73.72) + (49 x 5.41) + (50 x 5.18))/100 **OR** (379.50 + 349.68 + 3538.56 + 265.09 + 259.00)/100 ✓ = 47.92 ✓	**2**	**2 x 2.5**	
		(ii)	$3p^6 4s^2 4d^2 / 3p^6 4d^2 4s^2$ ✓	**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)	**(i)**	 Hess cycle (element box and arrows) ✓ $\Delta_c H$ (= (4 x -394) + (5 x -286) + 327) = -2679 (kJ mol^{-1}) ✓	**2**	**2 x 2.6**	**IGNORE** state symbols
		(ii)	*One from:* • heat losses • evaporation from wick • conditions not standard	**1**	**3.4**	**ALLOW** incomplete combustion
	(d)		$C_4H_9OCOCH_3$ ✓ + H_2O ✓	**2**	**2 x 2.3**	**ALLOW** any unambiguous formula for ester **DO NOT ALLOW** C4H9COOCH3
				14		

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