F

GCE

Chemistry B (Salters)

H033/01: Foundations of chemistry

Advanced Subsidiary GCE

Mark Scheme for June 2019

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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.

Annotations available in RM Assessor

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

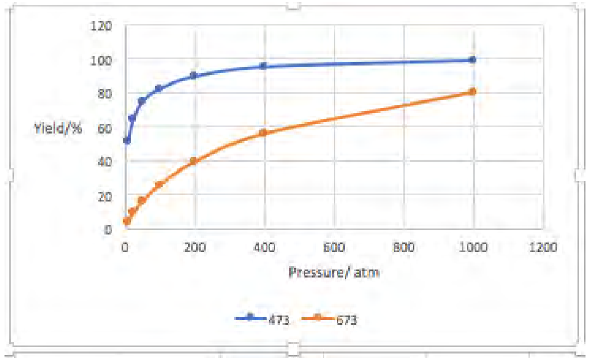
Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

Annotation	Meaning
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

Section A

Question	Key	AO element
1	A	**2.1**
2	B	**1.1**
3	D	**2.5**
4	B	**2.7**
5	D	**1.2**
6	A	**1.2**
7	B	**1.2**
8	A	**1.2**
9	C	**1.2**
10	D	**2.6**
11	C	**1.1**
12	D	**1.1**
13	B	**1.2**
14	A	**2.5**
15	C	**1.2**
16	D	**2.1**
17	C	**2.1**
18	B	**1.2**
19	C	**1.1**
20	A	**2.5**

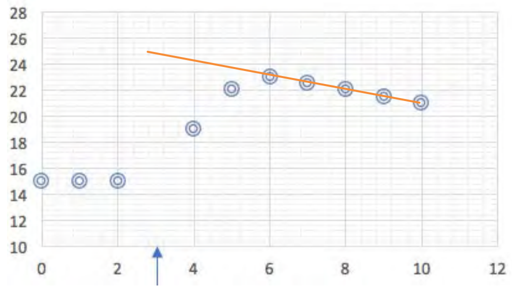
Section B

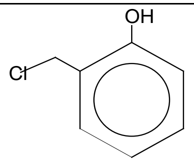
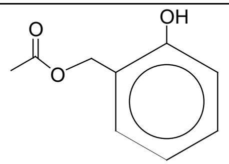
Question			Answer	Mark	AO element	Guidance
21	(a)		-46 kJ mol^{-1} ✓	1	1.1	Units and sign required
21	(b)		rates are equal / rates are the same ✓	1	1.1	
21	(c)	(i)	 pressure labelled on x-axis ✓ linear scales (filling at least ½ of grid in both directions) ✓ plot and lines of best fit ✓	3	2.6	Units not required. Y-axis does not require label but if present must be “yield” or “(eqm) %” y-axis scale should not extend beyond 100% **ALLOW** point to point or a curve which misses one point. labels/key not required but if present must be correct Line can extend to 0:0 or beyond 1000 atm
21	(c)	(ii)	no difference ✓ Catalysts do not affect yield/equilibrium (position) **AW** ✓	2	2.6	**ALLOW** Catalysts <u>only/just</u> affect rate **OR** Catalysts <u>only/just</u> affect the speed at which equilibrium is attained but **IGNORE** any other reference to rates
21	(c)	(iii)	more moles/molecules of reactants/left (ora) ✓	1	1.2	**ALLOW** 4 moles/molecules gives 2
21	(c)	(iv)	Two from ✓✓	2	3.2	

Question			Answer	Mark	AO element	Guidance
			• Yield cannot increase much/ is already nearly 100% • (Increasing pressure) is unsafe (**AW**)/expensive (**AW**)/uses more energy (**AW**) • (Increasing pressure means) equilibrium will be reached sooner		2.1	**ALLOW** Correct .(**AW**) ✓ If linked to one of first two bullet points **OR** Incorrect (**AW**) ✓ If linked to the third bullet point
	(c)	(v)	Molecules/particles move faster/have more energy ✓ More (frequent) collisions with energy greater than activation enthalpy/E_a ✓	2	1.2	"Atoms" **CON** first marking point **ALLOW** more successful collisions ✓
	(d)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.0869 award 2 marks** $K_c = [NH_3]^2/[N_2]\ [H_2]^3$ ✓ (= $0.00271^2/\ 0.0403\ 0.128^3$) = 0.0869 ✓	2	2.6	**IGNORE** units (not required at AS) **DO NOT ALLOW ecf** from wrong equation for K_c 1 mark is scored by a correct equation for K_c but an incorrect calculation.

Question			Answer	Mark	AO element	Guidance
22	(a)		It would react with BaO/BaO_2 ✓	1	2.5	**ALLOW** $BaCO_3$ would form
	(b)	(i)	$BaCO_3$ has higher (thermal) stability **AW**/*ora* ✓ Barium ion is larger *ora* ✓ Barium (ion) has smaller charge density *ora* / Both ions have the same/+2 charge✓ carbonate ion distorted/polarised less (by barium ion)*ora* ✓	4	1.2	**NOTE** "Ba^{2+} is bigger than Ca^{2+}" scores 2nd and 3rd marking points
	(b)	(ii)	Both (barium and calcium) are in same group/ same charge/2+ on ions ✓	1	1.1	
	(c)	(i)	$Ba(OH)_2 + 2HCl \rightarrow BaCl_2 + 2H_2O$ ✓	1	2.5	**IGNORE** state symbols
	(c)	(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.0566 / 0.057 (mol dm^{-3}) award 2 marks** amount HCl = 0.12 x 23.6/1000 **OR** 2.83(2)x 10^{-3} mol ✓ concentration $Ba(OH)_2$ = (ans to first mark x 1000/ 25 ÷2) = 0.0566 / 0.057 (mol dm^{-3}) ✓	2	2.8	**ALLOW** two or more sf. **ALLOW ecf** from (c)(i), i.e. incorrectly balanced equation 0.114 or 0.113 scores 1 mark unless correctly scored by ecf from c(i)
		(iii)	(0.0566 x 171.3 =) 9.70 (g dm^{-3}) ✓	1	2.8	**ALLOW** two or more sf. **ALLOW ecf** from c(ii) **ALLOW** 9.76 (Concentration rounded to 0.057) **ALLOW** 9.68 or 9.75 (Mr 171 used)

Question			Answer	Mark	AO element	Guidance
23	(a)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 25 (kJ mol^{-1}) award 3 marks** Energy absorbed = 200 x 4.18 x 3 = 2.508 (kJ) ✓ 2.508 x 80/8 = 25 (to any sf) (kJ mol^{-1}) ✓ 2 sf ✓	3	2.4	**ALLOW ecf** **ALLOW** use of 208 for mass of water (gives 26) Award third mark separately for any <u>calculated</u> answer to 2 sf
23	(a)	(ii)	Greater mass/moles (of nitrate) (in same volume of water) is correct (**AW**). **AND** more water is incorrect. **AW**✓ Greater volume (with same mass of nitrate) would decrease temperature change **AW** ✓	2	3.3	**ALLOW** mathematical treatment stating effect of changed mass/moles (of nitrate) AND changed volume (of water) on ΔT **NOTE** second marking point subsumes part of first marking point
23	(b)	(i)	Weigh out $CuSO_4{\bullet}5H_2O$/copper sulfate ✓ Dissolve to make 0.2 moldm^{-3} solution✓ Put 100cm^3 (of solution) into a suitable vessel (e.g insulated cup) and measure temperature✓ (Weigh) less than 1.3g/0.02 mol of Zn (powder) ✓ Add (zinc powder), (stir) and measure highest temperature reached✓	5	3.3 3.3 1.2 3.4 1.2	**ALLOW** for first two marking points any **method** that produces a 0.2M solution **NOTE** Dissolve 5g of $CuSO_4{\bullet}5H_2O$/copper sulfate in 100 cm^3 (of water) gains first two marking points If 100cm^3 is mentioned as above it is not required here **ALLOW ecf** based on incorrect molarity of copper sulfate solution but not volume

Question			Answer	Mark	AO element	Guidance
23	(b)	(ii)	 line plotted and extrapolated back to 3 minutes ✓ value read off at 3 mins = 24.5, so rise is 9.5(°C) ✓	2	3.3	Must be some evidence of extrapolation on graph for first marking point (e.g. a cross at 3mins/24.5C) **ALLOW** 9.25 to 9.75 “8” gains 1 mark (peak T minus starting T)

Question			Answer	Mark	AO element	Guidance
24	(a)		phenol ✓ (primary) alcohol ✓	2	1.1	
24	(b)		(conc sulfuric) acid/H^+/acidified **AND** (potassium/sodium) dichromate(VI)/ dichromate✓ Heat/reflux✓	2	1.2	**ALLOW** formulae but ignore if correct names given. **ALLOW** minor spelling mistakes **ALLOW** specified temperature between 60 and 100C **ALLOW** high temperature **ALLOW** warm
24	(c)	(i)	dissolve in hot/warm water/solvent ✓ minimum volume ✓	2	1.2	
24	(c)	(ii)	melting point is higher/ has smaller range/ more defined ✓	1	1.2	**ALLOW** melting point is closer to text book/reference value **IGNORE** references to TLC
24	(d)		No reaction with sodium carbonate – phenols (and alcohols) do not react with carbonates ✓ will not dehydrate/make a double bond ✓ because there is no H on the carbon adjacent to the carbon with the OH group ✓	3	3.2	**DO NOT ALLOW ecf** from **(a)** **ALLOW** "2nd statement is incorrect" for 2nd marking point.
24	(e)	(i)	 ✓	1	2.3	**ALLOW** any correct formula including C_7H_7OCl
24	(e)	(ii)	 ✓	1	2.3	**Must** be skeletal **ALLOW** O-H

Question			Answer	Mark	AO element	Guidance
24	(f)		Both form hydrogen bonds because of OH groups/hydroxyl/O bonded to H ✓ salicyl alcohol has more (hydrogen bonds/OH) so has stronger intermolecular bonds/forces ✓	2	2.1	**ALLOW** salicyl alcohol has more (hydrogen bonds/OH) so more energy is needed to overcome them - for second marking point

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