OCR
Oxford Cambridge and RSA

GCE

Chemistry B

Unit **H433/03:** Practical skills in chemistry

Advanced GCE

Mark Scheme for June 2018

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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
	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

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

Subject-specific Marking Instructions

INTRODUCTION

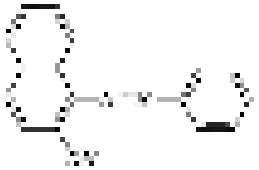
Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

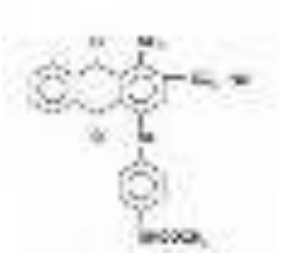
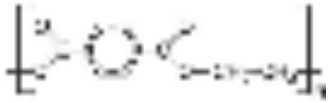
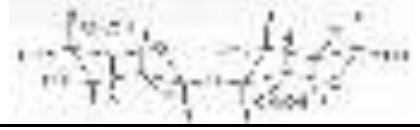
- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

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.

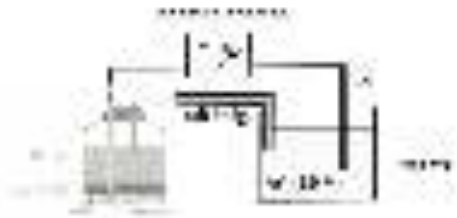
Question			Answer	Marks	Guidance
1	(a)		(conc) Hydrochloric acid / sulphuric and sodium nitrate(III)/nitrite ✓ Phenylamine / aminobenzene✓ Below 5^0C/ice cold (solution) ✓	3	**ALLOW** nitrous acid for first mark name or formula **IGNORE nitric acid** If acid named with oxidation state it must have correct oxidation state i.e. lll **ALLOW** hydrochloric acid under 'Conditions' for <u>first</u> mark Alkaline conditions **CON**
	(b)	(i)	 ✓	1	 **ALLOW**
		(ii)	alternating double and single bonds **OR** conjugated system **OR** delocalisation of <u>electrons</u> ✓ **split** into different electronic energy levels **OR** electron(s) promoted **OR** excited from lower to higher level **OR** electron(s) excited to a higher energy level✓ can absorb <u>visible/coloured</u> light (causing electrons to be promoted to upper level)✓ reflected/transmitted light complimentary colour ✓	4	The idea of split (electronic) energy levels needed for this mark (energy gap on <u>own</u> not good enough) **NOT** energy states Emit colour/light is **CON** **ALLOW** opposite colour

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td>Colour</td><td>1</td><td>ALLOW the chromophore.
IGNORE any reference to specific colour. For (c)(i) and (c)(ii) must talk about a dye property
IGNORE references to bonding possibilities</td></tr>
<tr><td></td><td>(c)</td><td>(ii)</td><td>Solubility OR <u>more</u> soluble</td><td>1</td><td>LESS soluble is a CON</td></tr>
<tr><td></td><td>(d)</td><td></td><td>
<table>
<tr><th>Type of fabric</th><th>Structure/features of fibre polymer molecule.</th><th>Structure/features of dye molecule</th><th>Strongest type of attachment</th></tr>
<tr><td>Wool</td><td>A protein chain with $-NH_3^+$ groups at the end of side chains when dyed in acid solution</td><td>  </td><td>ionic</td></tr>
<tr><td>polyester</td><td>  </td><td>Few polar groups on dye molecule</td><td>Permanent dipole/Permanent dipole</td></tr>
<tr><td>Cotton</td><td>  </td><td>Several $-NH_2$ groups. Linear molecule</td><td>H (bonding)</td></tr>
</table>
</td><td>2</td><td>Number of ticks must match mark given.

2 marks for all correct
1 mark for 2 or 3 out of four

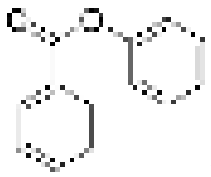
ALLOW id/id, pd/id or pd/pd</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>12</td><td></td></tr>
</table>

Question			Answer	Marks	Guidance
2	(a)	(i)	advantage: portable/no gas involved disadvantage: mercury toxic/poisonous ✓	1	one mark for **both** correct Ignore references to cost Harmful too vague
	(a)	(ii)	+1 ✓	1	sign needed **NOT** 1+
	(b)		**FIRST CHECK ANSWER ON THE ANSWER LINE** **If answer = 2.93 or 2.94 (dm^3) award 3 marks** Moles (n) assuming Hg_2Cl_2 = 25.0/472.2 = 0.0529/0.053 ✓ Volume = $\frac{nRT}{P}$ and substitution of correct values i.e. n (0.0529/0.053), R(8.314), T(673), p(101000), ✓ evaluation including conversion to dm^3 = 2.93/2.94 (dm^3)✓	3	**N.B**. 0.0529 gives 2.93, 0.053 gives 2.94 **ALLOW** ecf's from marking points one and two (the latter likely to be wrong units) Any appearance, stated or not, of 25/472.2 **OR** 0.0529/0.053 Look for any ecf on marking points 1 and 2
	*(c)		Please refer to the marking instructions on page 5 of this mark scheme for guidance on how to mark this question. **Level 3 (5 – 6 marks)** Detailed instructions on how to set-up the apparatus including the conditions and some justification of the apparatus used. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3 – 4 marks)** Learners present a workable setup of the apparatus including the conditions but little or no justification of the apparatus used. *The information presented is relevant and supported by some evidence.*	6	**Indicative scientific points may include:** **Set up** • make sure reading on voltmeter is positive • electrode/half-cell connected to positive terminal of voltmeter is the positive electrode • discussion of how E_{cell} can be used to find electrode potential of iron half cell **Description of the apparatus used and why** • high resistance voltmeter so negligible current is taken (so concs of ions stay the same) • salt bridge to keep the charge in each beaker constant. • both the above correctly connected to both cells • iron electrode and $Fe^{2+}(aq)$ solution in beaker so the reaction $Fe(s) \rightleftharpoons Fe^{2+}(aq)$ can take place

Question			Answer	Marks	Guidance
			Level 1 (1 – 2 marks) Learners present a partial set-up **OR** a simple labelled diagram with some relevant labels. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **Level 0** (no marks) No response or no response worthy of credit		**Conditions/concentrations** • 298K/25^{0}C • 1.00 mol dm^{-3} Fe^{2+}(aq) solution as E^0 is changed with higher temp and conc Note: some of the above points may be scored from a suitably labelled diagram, such as the one below 
	(d)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 1.6 x 10^{-18} mol^{3}dm^{-9} award 5 marks** Molar mass of Hg_2Cl_2 = 472.2 ✓ Solubility Hg_2Cl_2 in moldm^{-3} = 3.5 x 10^{-4} ÷ 472.2 = 7.41 x 10^{-7} ✓ K_{sp} = (7.41 x 10^{-7}) x (2 x 7.41 x 10^{-7})^2 ✓ = 1.6 x 10^{-18} ✓ Units = mol^{3}dm^{-9} ✓ irrespective of answer **BUT** if MASS concentration is used in the calculation the ecf on the units must be in terms of grammes see Guidance	**5**	Figure of 7.41 x 10^{-7} is worth 2 marks alone The x2 is commonly missed giving an answer of 4.1 x 10^{-19} and with correct units this answer should be awarded 4 marks. Calculations must be carried out on number of moles and **NOT** mass, but can allow sig fig mark and units mark if units are g^3 dm^{-9}. Look for ecf on units off K_{sp} equation. Must be 2 sig figs to score this mark (ecf off last marking point e.g. from above)
			Total	**16**	

Question			Answer	Marks	Guidance
3	(a)	(i)	(pale) yellow precipitate ✓	1	
		(ii)	$Ag^+(aq) + I^-(aq) \rightarrow AgI(s)$ ✓	1	All correct, allow IAg. Allow multiples.
	(b)	(i)	$2I^- \rightarrow I_2 + 2e^-$ ✓ loss of electrons	1	one mark for **both** correct **ALLOW** description of oxidation in terms of oxidation state of iodine increasing (from -1 to 0)
	(b)	(ii)	Sulfur ✓ +2, +2½ ✓	2	Sign needed **NO** ecf for iodine or oixygen
	(b)	(iii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 130 (µg) award 4 marks** Mole of thio = 0.0053 x 0.010 = 5.30 x 10^{-6} and moles of iodine = half above 2.65 x 10^{-6} ✓ Mass of iodine = above x 253.8 = 6.72 x 10^{-4} ✓ Mass of iodine in 120g = above ÷ 5 = 1.345 x 10^{-4}g ✓ 130(µg) (2 sig figs) ✓	4	**ALLOW** calculation method (and appropriate progress marks) where moles of I_2 in a 120g sample are calculated first, then mass**.** **Look for any ecfs.** This value has to be calculated from correct conversion to microgrammes
	(b)	(iv)	% error = $\frac{0.1}{5.3}$ x 100 = 1.886/1.9(%) ✓	1	1.89
		(v)	Dilute/lower concentration of thiosulphate solution **OR** increase mass of cod used **OR i**ncrease volume of iodine solution used✓	1	**IGNORE** answers which suggest more repeats needed, / “bigger”/”larger” sample
	*(c)		Please refer to the marking instructions on page 5 of this mark scheme for guidance on how to mark this question. **Level 3 (5 – 6 marks)** Detailed practical procedure **and** explains clearly how to process the results. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.*	6	**indicative scientific points may include:** **Procedure** • make a range of iodine solutions of different concentrations in hexane • minimum of 5 different concentrations • select filter showing maximum absorbance/complimentary colour • zero colorimeter using pure solvent (hexane) • measure absorbance for each of known concentrations of iodine solution

Question			Answer	Marks	Guidance
			Level 2 (3 – 4 marks) Learners present a workable practical procedure **and** some explanation of analysis but some detail lacking. *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1 – 2 marks)** Learners present a partial practical procedure, with some relevant points. **OR** Learners present some detail on the analysis/processing of results. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **Level 0** (no marks) *No response or no response worthy of credit*		**Processing of results** **Use of calibration graph** • plot a calibration curve of concentration against absorbance • measure absorbance of unknown sample and use calibration curve to determine concentration of unknown solution **Arriving at mass of iodine in sample** • convert mole concentration to mass (x253.8) • ÷ 50 (or x 20/1000) and convert to μg ($x10^6$)
			Total	**17**	

Question			Answer	Marks	Guidance
4	(a)	(i)	 ✓	1	**ALLOW** formulae of benzene rings using circle (and showing hydrogens) the key for the mark is the ester bonding correct. Benzene structure is needed **NOT** cycloalkane **NOT** C_6H_5
	(a)	(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 39.65/40(%) award 3 marks** Reacting mass ratio = 94 : 198 ✓ Theoretical mass of phenyl benzoate formed = $\frac{198}{94}$ x 4.91 = 10.34 ✓ % yield = $\frac{4.10}{10.34}$ x 100 = 39.65/40(%) ✓	3	**ALLOW** range of answers allowing for early rounding **39.65 – 41.41%** **ALLOW** Moles phenol = 4.91/94 =0.05223 ✓ Moles phenyl benzoate = 4.1/198 =0.0207✓ % yield =0.0207/0.05223 x 100 =39.65 ✓ If candidate has simply used the two calculated masses and has 83.5% (84%) allow one mark **ALLOW** ecfs from marking points 1 and 2
	(b)	(i)	$C_6H_5COCl + H_2O \rightarrow C_6H_5COOH + HCl$ ✓	1	**ALLOW** correct structural formulae or correct mixtures of formulae
	(b)	(ii)	Test used to see whether any (unreacted) phenol (left), (would go purple if some remained) ✓	1	**Both** ideas needed
	(b)	(iii)	Seal/melt end of melting point/capillary tube (in Bunsen) ✓ Tap/tip/pack a small amount of solid to bottom of tube ✓ Put tube in mp apparatus, allow temperature to rise slowly until solid melts **OR** record when it first starts to melt and when it finishes ✓	3	If unusual methods used please contact team leaders e.g. Siwoloboff's method, melting point bench
	(b)	(iv)	Indicates the presence of impurities / purity✓	1	**ALLOW** simply- indicates purity of product
	(b)	(v)	Solute must have high solubility(in solvent) when hot, but low when cold/**AW** ✓	1	**DO NOT** allow doesn't react with the product
	(c)		if more than one spot shows up on tlc ✓ phenyl benzoate impure ✓ ORA for mp 1 and 2 however cannot assess overall purity/cannot tell how pure or impure it is✓ not quantitative / is qualitative ✓	4	**Diagrams can be used here** **ALLOW** 'quantity' or references to % by mass of product
			Total	15	

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