

**Practice paper – Set 1****A Level Chemistry B****H433/01 Fundamentals of Chemistry****MARK SCHEME****Duration:** 2 hours 15 minutes**MAXIMUM MARK     110****Final**

**MARKING INSTRUCTIONS****PREPARATION FOR MARKING****SCORIS**

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *scoris assessor Online Training*; *OCR Essential Guide to Marking*.
2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal <http://www.rm.com/support/ca>
3. Log-in to scoris and mark the **required number** of practice responses (“scripts”) and the **required number** of standardisation responses.

YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

**MARKING**

1. Mark strictly to the mark scheme.
2. Marks awarded must relate directly to the marking criteria.
3. The schedule of dates is very important. It is essential that you meet the scoris 50% and 100% (traditional 50% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.
4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone, email or via the scoris messaging system.

5. Work crossed out:
- where a candidate crosses out an answer and provides an alternative response, the crossed out response is not marked and gains no marks
  - if a candidate crosses out an answer to a whole question and makes no second attempt, and if the inclusion of the answer does not cause a rubric infringement, the assessor should attempt to mark the crossed out answer and award marks appropriately.
6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add a tick to confirm that the work has been seen.
7. There is a NR (No Response) option. Award NR (No Response)
- if there is nothing written at all in the answer space
  - OR if there is a comment which does not in any way relate to the question (e.g. 'can't do', 'don't know')
  - OR if there is a mark (e.g. a dash, a question mark) which isn't an attempt at the question.
- Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).
8. The scoris **comments box** is used by your Team Leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**
- If you have any questions or comments for your Team Leader, use the phone, the scoris messaging system, or email.
9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response:

Read through the whole answer from start to finish, concentrating on features that make it a stronger or weaker answer using the indicative scientific content as guidance. The indicative scientific content indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance.

Using a 'best-fit' approach based on the science content of the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, **best** describes the overall quality of the answer using the guidelines described in the level descriptors in the mark scheme.

Once the level is located, award the higher or lower mark.

**The higher mark** should be awarded where the level descriptor has been evidenced and all aspects of the communication statement (in *italics*) have been met.

**The lower mark** should be awarded where the level descriptor has been evidenced but aspects of the communication statement (in *italics*) are missing.

**In summary:**

- **The science content determines the level.**
- **The communication statement determines the mark within a level.**

Level of response questions on this paper are **32(a)** and **35(g)**.

## 11. Annotations

| Annotation          | Meaning  |
|---------------------|--|
| <b>DO NOT ALLOW</b> | Answers which are not worthy of credit                     |
| <b>IGNORE</b>       | Statements which are irrelevant                            |
| <b>ALLOW</b>        | Answers that can be accepted                               |
| ( )                 | Words which are not essential to gain credit               |
| —                   | Underlined words must be present in answer to score a mark |
| <b>ECF</b>          | Error carried forward                                      |
| <b>AW</b>           | Alternative wording  |
| <b>ORA</b>          | Or reverse argument  |

## 12. 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.

## Section A

| Question | Answer | Marks | Guidance |
|----------|--------|-------|----------|
| 1        | A      | 1     |          |
| 2        | C      | 1     |          |
| 3        | A      | 1     |          |
| 4        | D      | 1     |          |
| 5        | C      | 1     |          |
| 6        | A      | 1     |          |
| 7        | B      | 1     |          |
| 8        | C      | 1     |          |
| 9        | C      | 1     |          |
| 10       | D      | 1     |          |
| 11       | D      | 1     |          |
| 12       | D      | 1     |          |
| 13       | A      | 1     |          |
| 14       | C      | 1     |          |
| 15       | A      | 1     |          |
| 16       | A      | 1     |          |
| 17       | B      | 1     |          |
| 18       | D      | 1     |          |
| 19       | B      | 1     |          |
| 20       | B      | 1     |          |
| 21       | D      | 1     |          |
| 22       | B      | 1     |          |
| 23       | C      | 1     |          |
| 24       | B      | 1     |          |
| 25       | D      | 1     |          |
| 26       | A      | 1     |          |
| 27       | D      | 1     |          |
| 28       | B      | 1     |          |
| 29       | A      | 1     |          |
| 30       | B      | 1     |          |
|          | Total  | 30    |          |

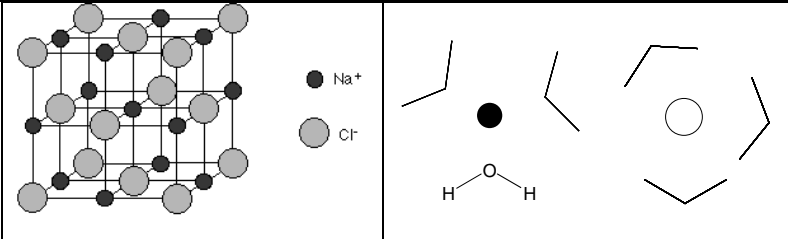
## Section B

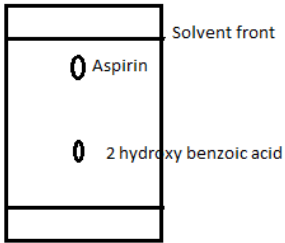
| Question |     |      | Answer  | Marks | Guidance  |
|----------|-----|------|---|-------|---|
| 31       | (a) |      | $\text{Ca(OH)}_2(\text{s}) + \text{CO}_2(\text{g}) \rightarrow \text{CaCO}_3(\text{s}) + \text{H}_2\text{O}(\text{l})$  | 1     | State symbols must be included  |
|          | (b) |      | <b>FIRST CHECK ANSWER ON ANSWER LINE</b><br>answers rounding to 5.7 (g) award 3 marks<br>Amount $\text{CO}_2 = \text{PV/RT} \checkmark$<br>$0.0004 \times 5.0 \times 9.5 \times 10^4 / 8.314 \times 296$ <b>OR</b> $0.0772 \dots$<br>(= amount $\text{Ca(OH)}_2$ ) $\checkmark$<br>Mass $\text{Ca(OH)}_2 (= 0.0772 \times 74.1) = 5.7 \text{ (g)} \checkmark$ | 3     | Ecf from second point<br><b>ALLOW</b> 74 for formula mass of $\text{Ca(OH)}_2$<br><b>ALLOW</b> answer to 2 or more sf |
|          | (c) | (i)  | $((10 \times 0.113)/74.1 =) 0.0152 \checkmark$  | 1     |   |
|          | (c) | (ii) | <b>FIRST CHECK ANSWER ON ANSWER LINE</b><br>answers rounding to 164 ( $\text{cm}^3$ ) award 2 marks<br>Moles of $\text{Ca(OH)}_2$ needed = $250 \times 0.01/1000 (= 0.0025) \checkmark$<br>Volume = $0.0025 \times 1000 / 0.0152 = 164 \text{ (cm}^3\text{)} \checkmark$  | 2     | Ecf from first point and ci<br><b>ALLOW</b> 2 or more sf  |
|          | (d) | (i)  | Bubbles/ gas/ hydrogen given off $\checkmark$<br>white precipitate/ white suspension/ cloudy $\checkmark$   | 2     |   |
|          | (d) | (ii) | Slower reaction (AW)/ no reaction (AW) $\checkmark$   | 1     |   |
|          | (e) | (i)  | $\text{Mg}(\text{g}) \rightarrow \text{Mg}^+(\text{g}) + \text{e}^- \checkmark$   | 1     | <b>ALLOW</b> 'e' for 'e <sup>-</sup> '<br><b>IGNORE</b> state symbol on e <sup>-</sup>                                |
|          | (e) | (ii) | Ca more reactive as ionisation energy is lower $\checkmark$<br>outer electron(s) more easily removed $\checkmark$   | 2     |   |
| Total    |     |      |   | 13    |   |

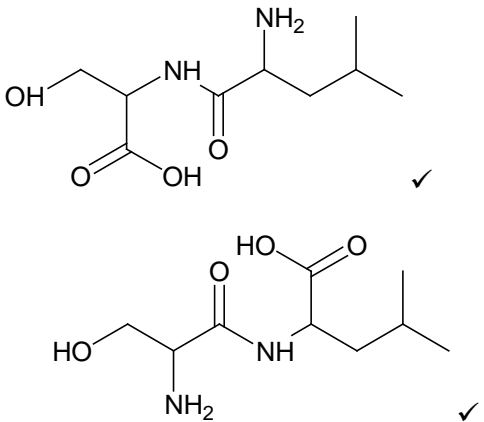
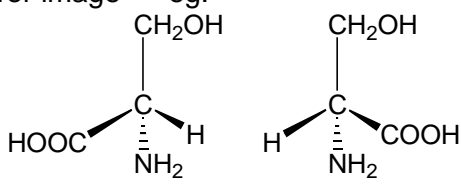
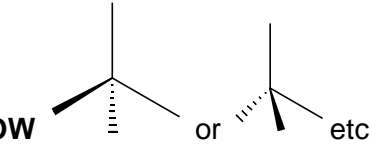

| Question |      | Answer  | Marks | Guidance   |
|----------|------|---|-------|--|
| 32       | (a)* | <p><i>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</i></p> <p><b>Level 3 (5–6 marks)</b><br/>Learners demonstrate knowledge and understanding of the appearance and origin of atomic emission spectra and can apply this knowledge of scientific ideas in explaining how the lines can be used to identify elements.</p> <p><i>The answer is logical and well structured</i></p> <p><b>Level 2 (3–4 marks)</b><br/>Learners demonstrate reasonable knowledge and understanding of the appearance and origin of atomic emission spectra. They can partially apply this to explaining how the lines can be used to identify elements.</p> <p><i>The points made are logical and well structured</i></p> <p><b>Level 1 (1–2 marks)</b><br/>Learners <b>either</b> demonstrate some knowledge and understanding of the appearance and origin of atomic emission spectra and can begin to apply this to explaining how the lines can be used to identify elements <b>or</b> they show reasonable understanding in either area.</p> <p><i>Such points as are made are in a logical sequence</i></p> <p><b>0 marks</b><br/>No response or no response worthy of credit.</p> | 6     | <p><b>Indicative scientific points may include:</b></p> <p><b>Appearance and origin</b></p> <ul style="list-style-type: none"> <li>• atoms absorb energy</li> <li>• electrons move up energy levels</li> <li>• energy levels quantised</li> <li>• (electrons) drop back down</li> <li>• emit light</li> <li>• <math>\Delta E = h\nu</math></li> <li>• give coloured lines</li> </ul> <p><b>How lines can be used</b></p> <ul style="list-style-type: none"> <li>• atoms of each element have their own specific energy levels</li> <li>• thus different gaps</li> <li>• thus different frequency lines</li> <li>• frequencies of lines can be checked against a database</li> </ul> <p><b>ALLOW</b> points made on a <b>labelled</b> diagram</p> |
| 32       | (b)  | <p><b>FIRST CHECK ANSWER ON ANSWER LINE</b><br/>answer = 226 (kJ mol<sup>-1</sup>) award 3 marks<br/>Use of <math>E=h\nu</math> and <math>c=\lambda\nu</math> to get <math>E=hc/\lambda</math>, ✓<br/>Look up and use values for h and c <b>AND</b> evaluate,<br/>(<math>E=6.63 \times 10^{-34} \times 3.00 \times 10^8 / 5.303 \times 10^{-7}</math>) = 3.751 x 10<sup>-19</sup> ✓</p>   | 3     | <p>Ecf from point 1</p> <p>An answer to more than 3 sf rounding to 226 scores 2 marks.</p>   |

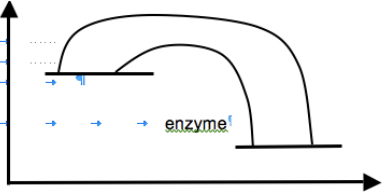
| Question |     |  | Answer   | Marks     | Guidance   |
|----------|-----|--|--|-----------|--|
|          |     |  | Multiply by $N_A$ AND divide by 1000 to get $\text{kJ mol}^{-1}$ <b>AND</b> 226 ( $\text{kJ mol}^{-1}$ ) ✓ (3sf [data])  |           |  |
| 32       | (c) |  | $\text{Fe}^{13+} 1s^2 2s^2 2p^6 3s^2 3p^1$ ✓   | 1         | <b>ALLOW</b> capital letters but numbers must be superscript.      |
| 32       | (d) |  | <b>FIRST CHECK ANSWER ON ANSWER LINE</b><br>answer $A_r = 55.91$ award 2 marks<br>$A_r = [(5.85 \times 54) + (91.75 \times 56) + (2.12 \times 57) + (0.28 \times 58)]/100$ ✓<br>$A_r$ (to 2dp) = 55.91 ✓ | 2         | Ecf from first part<br><br>Numbers rounding to 55.93 score 1 mark. |
| 32       | (e) |  | $^{10}_{12}\text{Mg}$ ✓<br>n in both equations ✓   | 2         |  |
|          |     |  | <b>Total</b>   | <b>14</b> |  |

| Question |     |      | Answer   | Marks | Guidance   |
|----------|-----|------|--|-------|--|
| 33       | (a) | (i)  | Place known volume/mass of water in a (polystyrene) beaker ✓<br>Weigh out (a suitable/calculated mass) / add a known mass of ammonium nitrate and add to water with stirring ✓<br>Measure temperature of water before and after ✓  | 3     |  |
|          | (a) | (ii) | $(100/17) = 6(\%)$ ✓   | 1     | <b>ALLOW</b> any sf rounding to 6  |
| 33       | (b) |      | $\underline{\text{NH}_4^+(\text{g}) + \text{NO}_3^-(\text{g})}$ ✓<br><br>$\text{NH}_4^+(\text{aq}) + \text{NO}_3^-(\text{aq})/\underline{\text{NH}_4\text{NO}_3(\text{aq})}$ ✓<br><br>$\underline{\text{NH}_4\text{NO}_3(\text{s})}$ ✓<br><br>$\Delta_{\text{hydration}} H \text{NO}_3^- (= 25 - (645 + 307) =) - 313$ ✓ | 4     | <b>IGNORE</b> axes and labels<br><br>line must be above the $\text{NH}_4\text{NO}_3(\text{s})$ line to score this mark<br><br>must have negative sign to score |
| 33       | (c) |      | More exothermic/ more negative ✓<br>Cl smaller/ greater charge density ✓<br>more strongly attracted to the ammonium ion ✓  | 3     | Not just 'larger'  |

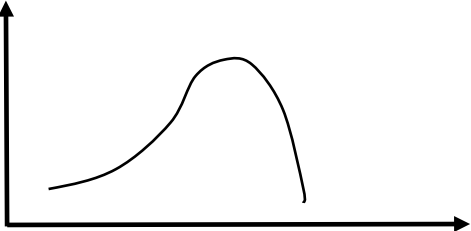
| Question |     |      | Answer  | Marks     | Guidance  |
|----------|-----|------|---|-----------|---|
| 33       | (d) | (i)  |  <p>Each ion surrounded by at least 3 water molecules (minimum as shown) ✓<br/> one with O and H labelled and correct atoms pointing to correct ion ✓</p> | 2         | Dipoles not required but, if they are wrong they are CON to second mark |
| 33       | (d) | (ii) | <p>Bonds broken: ionic bonds <b>AND</b> hydrogen bonds ✓<br/> Bonds made: ion dipole bonds ✓</p>  | 2         | <b>NOT</b> ionic dipole   |
|          |     |      | <b>Total</b>  | <b>15</b> |   |

| Question |     |      | Answer   | Marks     | Guidance   |
|----------|-----|------|--|-----------|--|
| 34       | (a) |      | $\text{C}_6\text{H}_4(\text{OH})\text{CO}_2\text{H} + (\text{CH}_3\text{CO})_2\text{O} \rightarrow \text{C}_6\text{H}_4\text{CO}_2\text{H}(\text{OCOCH}_3) + \text{CH}_3\text{COOH}$<br>Ethanoic anhydride <b>AND</b> aspirin ✓<br>Ethanoic acid product ✓   | 2         | <b>ALLOW</b> any unambiguous formulae and a mixture of displayed and structural formulae   |
| 34       | (b) |      | Sketch and label 2 spots with:<br>aspirin more than half-way up<br>salicylic acid less than half-way up<br>   | 1         | start line and solvent front do not have to be marked.   |
| 34       | (c) |      | Aspirin must have a greater solubility at higher temperature <b>SO</b> it will crystallise on cooling AW ✓   | 1         |  |
| 34       | (d) |      | <b>FIRST CHECK ANSWER ON ANSWER LINE</b><br>answers rounding to 32.5 (g) award 2 marks<br>Moles of aspirin made = $29.5/180$ <b>AND</b> moles of 2-hydroxybenzoic acid = $(29.5 \times 100)/(180 \times 69.5) = 0.236$ ✓<br>= 32.5 (g) (Multiplication by 138) ✓   | 2         | <b>ALLOW</b> 3 or more sf  |
| 34       | (e) | (i)  | 1 electron from each carbon ✓<br>is delocalised (so all bonds are equal) ✓   | 2         |  |
| 34       | (e) | (ii) | 1. Electrons move to a higher energy level ✓<br>2. absorbing em radiation $\Delta E = h\nu$ ✓<br>3. Yellow dye has more delocalisation/ larger chromophore <b>AND</b> energy levels are closer together/ $\Delta E$ is smaller ✓<br>4. Energy absorbed is at lower visible frequencies ✓<br>5. complementary colour is transmitted ✓ | 5         | <b>ALLOW</b> reverse:<br>3. Benzene has less delocalisation/ smaller chromophore <b>AND</b> energy levels are further apart.<br>4. Energy absorbed is higher frequency (in the UV)<br>5. all visible colours transmitted |
|          |     |      | <b>Total</b>   | <b>15</b> |  |

| Question | Answer  | Marks | Guidance  |
|----------|---|-------|---|
| 35 (a)   | <p>Correct amide link in 1 structure ✓</p> <p>Fully correct skeletal structures 1 each, eg:</p>  | 3     |   |
| (b)      | <p>One correct 3d representation ✓</p> <p>Mirror image ✓ eg:</p>                                | 2     | <p><b>ALLOW</b>  or etc</p> <p><b>NOT</b> </p> |
| (c)      | <p>They have an <u>active site</u> ✓</p> <p>Substrate binds to the active site and reacts with lower <math>E_A</math> ✓</p>   | 2     |   |

| Question |     |      | Answer   | Marks | Guidance  |
|----------|-----|------|--|-------|---|
|          | (d) |      | Shapes of the 2 curves with enzyme one at lower $E_A$ ✓<br>   | 1     | Activation enthalpies do not need to be labelled<br>One line must be labelled 'enzyme' or 'no enzyme' |
|          | (e) | (i)  | Draw a graph of volume of oxygen against time. ✓<br>Draw tangent and its gradient gives the rate. ✓  | 2     |   |
|          | (e) | (ii) | <b>FIRST CHECK ANSWER ON ANSWER LINE</b><br>answers rounding to 1.67 (mol dm <sup>-3</sup> ) award 2 marks<br>20 cm <sup>3</sup> O <sub>2</sub> = 20/24000 mol ✓<br>Conc of H <sub>2</sub> O <sub>2</sub> (= (1000 x 2 x 20)/24000) = 1.67 (mol dm <sup>-3</sup> ) ✓ | 2     | <b>ALLOW</b> 2 or more sf   |

| Question |     | Answer  | Marks | Guidance   |
|----------|-----|---|-------|--|
|          | (f) | Correctly plots points ✓<br>Line of best fit drawn ✓  | 2     |  |
|          | (g) | <p><i>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</i></p> <p><b>Level 3 (5–6 marks)</b><br/>Learners fully analyse the scientific information shown on the graph concerning orders of reaction. They correctly evaluate the learners' comments and interpret them in terms of the correct chemistry.</p> <p><i>The explanation is relevant and logically structured and contains no errors.</i></p> <p><b>Level 2 (3–4 marks)</b><br/>Learners partially analyse the scientific information on the graph concerning orders of reaction AND they partially correct the learners' conclusion.<br/><b>OR</b> they do one aspect fully and the other weakly.</p> <p><i>The explanation is generally relevant and logically structured and contains few errors.</i></p> <p><b>Level 1 (1–2 marks)</b><br/>Learners show some ability to analyse the graph or to correct the learners' conclusion</p> <p><i>A partial explanation is attempted and has some structure.</i></p> <p><b>0 marks</b><br/>No response or no response worthy of credit.</p> | 6     | <p><b>Indicative scientific points may include:</b></p> <p><b>Orders of reaction</b></p> <ul style="list-style-type: none"> <li>graph is a straight line/shows proportionality for low substrate concentrations</li> <li>shows reaction is first order initially</li> <li>then graph has zero slope/ rate does not change as substrate conc increases</li> <li>so zero order wrt substrate at high substrate conc.</li> <li>no conclusions can be drawn about order wrt enzyme as concentration is not changed.</li> </ul> <p><b>Rate determining steps</b></p> <ul style="list-style-type: none"> <li>mechanism is <math>E + S \rightarrow ES \rightarrow E + \text{products}</math></li> <li>Rate determining step at low substrate concentration is <math>E + S \rightarrow ES</math></li> <li>since this indicates first order</li> <li>Explanation of ES</li> <li>This is not the rate-determining step at high substrate concentration</li> <li>Here it is <math>ES \rightarrow \text{products}</math> <b>or</b> enzyme is saturated with substrate</li> </ul> |

| Question |     |  | Answer  | Marks     | Guidance                       |
|----------|-----|--|---|-----------|--------------------------------|
|          | (h) |  |  <p>Shape of graph: rises to peak, then falls ✓<br/> Initially as temperature increases more collisions above <math>E_A</math>, so increasing rate ✓<br/> then the kinetic energy breaks imbs in active site and it loses its specific shape and substrate can't bind. ✓</p> | 3         | ALLOW enzyme becomes denatured |
|          | (i) |  | <p>Advantage: Allows faster reaction at lower temp/ saves fuel ✓<br/> Disadvantage: easily denatured/inhibited/ sensitive to pH/ difficult to recover after use. ✓</p>  | 2         |                                |
|          |     |  | <b>Total</b>  | <b>23</b> |                                |