

chemmMOEENGZ0XXXX



Markscheme

November 2024

Chemistry

On-screen examination








16 pages










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The following are the annotations available to use when marking responses.

| Annotation | Explanation |
|---|--|
|  | Correct point, place at the point in the response where it is clear that the candidate deserves the mark. For use in analytically marked questions only. |
|  | Omission, incomplete |
| CON | Contradiction |
|  | Valid part (to be used when more than one element is required to gain the mark) |
|  | Error carried forward |
|  | Dynamic annotation, it can be expanded to surround work |
|  | Underline tool that can be expanded |
|  | Highlight tool that can be expanded to mark an area of a response |

| Annotation | Explanation |
|---|--|
|  | Not good enough |
|  | The candidate has given a response but it is not worthy of any marks |
|  | Text box used for additional marking comments |
|  | Seen; must be stamped on all blank response areas and on duplicate pages of concatenated responses |
|  | Vertical wavy line that can be expanded |
|  | Words to that effect |
|  | Award 1, 2, 3, 4 marks. For use in holistically marked questions only |

Markscheme instructions

- 1 Mark positively. Give candidates credit for what they have achieved and what is correct. Do not deduct marks for incorrect responses. Do not deduct marks for spelling errors.
- 2 Follow the markscheme provided and award only whole marks.
- 3 Each marking point appears on a separate line.
- 4 The maximum mark for each subpart is indicated in the "Total" column.
- 5 Where a mark is awarded a tick should be placed in the text at the precise point where it is clear the candidate deserves the mark.
- 6 Each marking point in a question part should be awarded separately unless there is an instruction to the contrary in the Notes column.
- 7 A question subpart may have more marking points than the total allows. This will be indicated by the word "**max**" in the Answer column. Further guidance may be given in the Notes column.
- 8 Additional instructions on how to interpret the markscheme are in bold italic text in the Answer column.
- 9 Alternative wording may be indicated in the Answer column by a slash (/). Either alternative is equally acceptable but the candidate cannot be rewarded for both as they are associated with the same marking point.
- 10 Alternative answers are indicated in the Answer column by "**or**". Either alternative is equally acceptable but the candidate cannot be rewarded for both as they are associated with the same marking point.
- 11 If two related points are required to award a mark, this is indicated by "**and**" in the answer column.
- 12 Words in brackets () in the Answer column are not necessary to gain the mark.
- 13 Words that are underlined are essential for the mark.
- 14 In some questions a reverse argument is also acceptable. This is indicated by the abbreviation *ORA (or reverse argument)* in the Notes column. Candidates should not be rewarded for reverse arguments unless *ORA* is given in the Notes column.
- 15 If the candidate's response has the same meaning or is clearly equivalent to the expected answer the mark should be awarded. In some questions this is emphasized by the abbreviation *WTTE (or words to that effect)* in the Notes column.
- 16 When incorrect answers are used correctly in subsequent question parts the follow through rule applies. Award the mark and add ECF (error carried forward) to the candidate response.
- 17 The order of marking points does not have to be the same as in the Answer column unless stated otherwise.
- 18 Marks should not be awarded where there is a contradiction in an answer. Add CON to the candidate response at the point where the contradiction is made.
- 19 Do not penalize candidates for errors in units or significant figures unless there is specific guidance in the Notes column.
- 20 Questions with higher mark allocations will generally be assessed using a level response method using task specific clarifications developed with reference to the criteria level descriptors. A candidate's work should be reviewed to determine holistically the mark for each row of the holistic grid and a mark awarded for each row.

| Question | | Answers | Notes | Total | |
|----------|---|--|-----------------------------|-------|---|
| 1 | a | Transition metals | | 1 | A |
| | b | Boiling point | | 1 | A |
| | c | <p>X to Y: Liquid to gas</p> <p>Particles get further apart or have more energy or gain energy or move faster</p> <p>Y to Z: Gas to liquid</p> <p>Particles have less energy or particles lose energy or particles get closer together</p> | | 4 | A |
| | d | B | | 1 | A |
| | e | <p>Correct RAM for each element (Fe=56, S=32, O=16)</p> <p>Correct formula mass = 152</p> | Ignore any units if present | 2 | A |

| | | | | | |
|---|---|---|--|---|------------|
| 2 | a | Covalent ▾ | | 1 | A |
| | b | <p>Cork: pressure has been released</p> <p>Champagne: the increase in pressure pushes the liquid out</p> <p>Bubbles: bubbles form by the gas/CO₂ being released <i>or</i> as pressure drops</p> | | 3 | A |
| | c | <p>440000/44 = 10000 moles of CO₂</p> <p>Ratio is 1:1 or 10000 moles of methanol</p> <p>Mass of methanol 10000 x 32 = 320000(g)</p> <p>3.2x10⁵ (g)</p> | <p><i>Do not accept answers in kg</i></p> <p><i>No ecf</i></p> | 4 | A D |
| | d | <p>Providing an alternative pathway</p> <p>With a lower energy</p> <p>Without itself being used up</p> | | 3 | A |

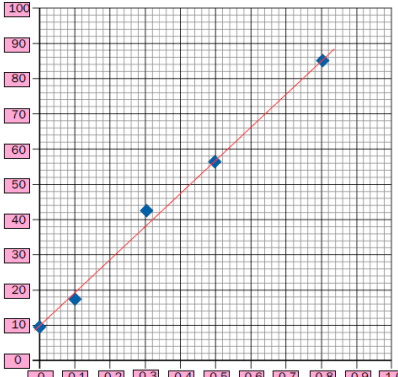
| | | | | | |
|----------|----------|---|----------------------------|----------|---|
| 3 | a | <input type="text" value="Oxygen"/> | | 1 | A |
| | b | Nitrogen group: <input type="text" value="5"/> Argon period: <input type="text" value="3"/> | <i>Accept group 15</i> | 2 | A |
| | c | 2, 8, 8 <i>or</i> $1s^2 2s^2 2p^6 3s^2 3p^6$ Complete outer shell/full octet (So) no need to share <i>or</i> donate electrons to form bonds | <i>Mp 2 can be implied</i> | 3 | A |
| | d | When air enters, <u>oxygen</u> is present (the filament) oxidises <i>or</i> reacts with oxygen <i>or</i> combusts (causing an explosion) | | 2 | A |

| | | | | | |
|---|---|---|--|---|---|
| 4 | a | What is the effect of fluoride ions on tooth filling materials? | | 1 | B |
| | b | <p>IV: Tooth material or filling material</p> <p>DV: Conductivity of the liquid or F⁻ concentration</p> <p>Accept any reasonable CV, for example [max 2]</p> <ul style="list-style-type: none"> • <u>initial/starting</u> concentration of ions • temperature of liquid • size or volume or mass of filling material • surface area of filling material teeth • duration of submersion • length of probe in solution • volume of liquid | <i>Do not accept pressure, do not accept amount</i> | 4 | B |
| | c | <p>Justification:</p> <p>Liquid does not cover the filling material or A different volume of liquid was used or Insufficient liquid was used or No more filling material can be dissolved</p> <p>Validity:</p> <p>(so) the method is not valid</p> | <i>Do not award validity mark unless the justification mark is awarded</i> | 2 | C |
| | d | <p>If...the teeth are cleaned with mouthwash and toothpaste</p> <p>Then...the teeth will be cleaner</p> <p>Because...the mouthwash can clean more of the surface area or is an extra stage of cleaning or more F⁻ are present</p> | <p>WTTE</p> <p>WTTE</p> <p>ORA</p> | 3 | B |


| | | | | | |
|---|---|---|---|---|---|
| | e | Brand B and trial 3 Accept any reasonable suggestion, for example [max 1] <ul style="list-style-type: none"> • conductivity meter needs to be calibrated • insufficient liquid • probe not submerged • contamination | <i>Accept 30 or other clear identification of this trial</i> <i>Do not accept "user error"</i> | 2 | C |
| | f | 176.6666 177 mgdm ⁻³ | | 3 | C |
| | g | Brand C and this has the highest initial concentration of fluoride ions or Brand D and this has the greatest reduction in fluoride ions or conductivity (after 10 minutes) | | 1 | C |
| | h | Accept any reasonable suggestion, for example [max 1] <ul style="list-style-type: none"> • more fluoride is needed for more teeth • body mass increases | | 1 | C |
| 5 | a | <input type="text" value="A colour change"/> | | 1 | A |

| 5 | b | | | | | 18 | B |
|------------|--|--|---|--|---|----|---|
| | 1 mark | 2 marks | 3 marks | 4 marks | Notes | | |
| 1.V | Explicitly states appropriate: IV or DV | Explicitly states appropriate: IV and DV | Explicitly states appropriate: IV and DV and one CV | Explicitly states appropriate: IV and DV and two CVs | <p><i>Only requirement is to state using the terminology of IV, DV and CV. No need to explain further. IV is roofing material</i></p> <p><i>DV must be measurable and not calculated, can be counting bubbles or volume or mass change of roofing material</i></p> <p><i>Do not accept rate of reaction as DV</i></p> <p><i>CV time, initial or starting mass of sample, temperature, volume of acid</i></p> <p><i>Do not accept surface area as this is given in the question</i></p> <p>Do not accept "keeping equipment the same" as a CV. Do not accept calculated values as DV unless explicitly shown how calculated from measured values.</p> | | |
| 2.E | One additional piece of equipment is selected | Specified equipment considers DV or CV | Specified equipment considers DV and one CV | Specified equipment considers DV and two CVs | <p><i>Equipment needs to be correct for the given situation and stated CVs. DV: balance or measuring cylinder CV: timer or stopwatch, thermometer, measuring cylinder</i></p> <p>Do not accept equipment that is mentioned in the question / instructions.</p> | | |
| 3.M | Method is linked to DV | Method is linked to IV / RQ and DV but is incomplete | Method linked to IV and DV and can be followed | Method linked to IV and DV and can be followed and include details on how to control main CVs and states how to calculate rate | <p><i>A method that does not include how to vary the IV is incomplete.</i></p> <p><i>Limited information about CVs mean that data is unlikely to be relevant</i></p> | | |
| 4.D | One roofing material is investigated | All roofing materials are investigated or one material is investigated with 3 repeats | All roofing materials are investigated and with at least 3 repeats | All roofing materials are investigated with repeats and plans to calculate means | <p><i>The values of the five or more variations should be explicitly stated for 3 or 4 marks</i></p> | | |
| 5.S | Relevant safety precaution or statement | Relevant justified safety precaution linked to the acid | | | <p><i>Do not accept general considerations not linked to the specific investigation, e.g. wear a mask, tie hair back</i></p> | | |

| | | | | | |
|--|----------|--|--|----------|----------|
| | c | Accept any reasonable suggestion, for example [max 1] <ul style="list-style-type: none">• volume or type of precipitation• frequency of precipitation• temperature• wind | | 1 | C |
|--|----------|--|--|----------|----------|

| | | | | | |
|---|---|--|--|---|---|
| 6 | a |  | Accept any order | 6 | C |
| | b | <p>Axis scales in equal increments starting at (0,0)</p> <p>5 points correctly plotted</p> <p>Line of best fit with points roughly even on both sides</p> <p>Title: to include concentration and (average) mass lost</p> <p>Axes: Concentration on x axis and (Average) mass lost on y axis</p> <p>Units included in both labels</p> <p>Trend: Concentration increases and Mass loss increases</p> <p>Linear</p> <p>Purpose: To see what would happen without NaCl or act as a control</p> | <p><i>Ignore proportional</i> <i>Award two marks for linear increase</i></p> <p><i>Do not accept references to fair test</i></p> | 3 | C |

| | | | | |
|---|---|--|---|---|
| c | <p>There is more mass lost as the concentration increases (therefore) the hypothesis is not valid or is invalid Collisions are needed between the nail surface and the NaCl (for a reaction to take place)</p> | <p><i>Only award mp 2 if mp 1 is awarded</i></p> | 3 | C |
| d | <p>Accept any reasonable suggestion, for example [max 1]</p> <ul style="list-style-type: none"> • to avoid damaging cutlery • too expensive and to test or use cutlery • gives consistent results • too much reagent would be required • the nail is behaving in the same way as cutlery | | 1 | C |

| 7 | a | <p>Accept any reasonable statements, for example [max 1]</p> <ul style="list-style-type: none"> • fossil fuels produce emissions (CO₂) • fossil fuels are harmful for the environment • solar panels or wind turbines do not produce emissions • renewable energy will not run out • non-renewable energy will run out • renewable energy is cheaper (than non-renewable) | 1 | D | | | | | | | | | | | | | | | |
|--------------------|--|---|---|--------|---------|---------|--------------|------------------------|------------------------------|--|--------------------|--|---|---|-------------------|------------------------|---------------------------|--|---|
| | b |  <p><i>Check carefully as radio button is not aligned to symbol</i></p> | 1 | D | | | | | | | | | | | | | | | |
| | c | <table border="1"> <thead> <tr> <th></th> <th>1 mark</th> <th>2 marks</th> <th>3 marks</th> </tr> </thead> <tbody> <tr> <td>Risks</td> <td>Safety risk is implied</td> <td>One safety risk is specified</td> <td>More than one safety risk is specified</td> </tr> <tr> <td>Precautions</td> <td>Precaution for one method of transport</td> <td>Precaution for two methods of transport</td> <td>Precaution for three methods of transport</td> </tr> <tr> <td>Conclusion</td> <td>A conclusion is stated</td> <td>A conclusion is justified</td> <td></td> </tr> </tbody> </table> | | 1 mark | 2 marks | 3 marks | Risks | Safety risk is implied | One safety risk is specified | More than one safety risk is specified | Precautions | Precaution for one method of transport | Precaution for two methods of transport | Precaution for three methods of transport | Conclusion | A conclusion is stated | A conclusion is justified | | 8 |
| | 1 mark | 2 marks | 3 marks | | | | | | | | | | | | | | | | |
| Risks | Safety risk is implied | One safety risk is specified | More than one safety risk is specified | | | | | | | | | | | | | | | | |
| Precautions | Precaution for one method of transport | Precaution for two methods of transport | Precaution for three methods of transport | | | | | | | | | | | | | | | | |
| Conclusion | A conclusion is stated | A conclusion is justified | | | | | | | | | | | | | | | | | |

| | | | |
|---|--|----|---|
| 8 | | 12 | D |
|---|--|----|---|

| Effects on the environment of either sea dumping or underground storage | | |
|---|--|---|
| Mark | Descriptor | Examples |
| 1 | A statement | <p>Statements</p> <ul style="list-style-type: none"> • dumping at sea is bad for the environment • dumping close to coast could cause contamination of beaches • underground storage areas need to be built • waste does not need to be transported as far for underground storage <p>Further support</p> <ul style="list-style-type: none"> • leakage from containers could impact the environment • (...contamination of beaches) so depth of sea would have to be checked • leakage from underground storage would be unlikely • less fuel is needed to transport to underground storage |
| 2 | A statement with further support | |
| 3 | Two statements with further support for both | |

| Economic impacts of either sea dumping or underground storage | | |
|---|--|--|
| Mark | Descriptor | Examples |
| 1 | A statement | <p>Statements</p> <ul style="list-style-type: none"> • More expensive for sea dumping • Large initial cost in setting up underground storage areas <p>Further support</p> <ul style="list-style-type: none"> • waste has to be transported to ports and then by ship to dumping ground • Underground storage is cheaper (after initial costs) because it can be stored for a long time |
| 2 | A statement with further support | |
| 3 | Two statements with further support for both | |

| Advantages and disadvantages of disposal in space | | |
|---|--|---|
| Mark | Descriptor | Examples |
| 1 | An advantage or a disadvantage | Advantage <ul style="list-style-type: none"> waste is no longer being stored on Earth Support <ul style="list-style-type: none"> so no hazard to life on Earth |
| 2 | An advantage and a disadvantage | Disadvantage <ul style="list-style-type: none"> if rocket exploded on launch/flight, nuclear debris could fall a robotic flight / non-reusable rocket would be needed |
| 3 | An advantage and a disadvantage with support for one | Support <ul style="list-style-type: none"> widespread radioactivity (robotic flight) could make it more expensive |
| 4 | An advantage and a disadvantage with support for both | |

| A justification of your opinion on which is the best method for storing or disposing of radioactive waste | | |
|---|---|----------|
| Mark | Descriptor | Examples |
| 1 | A concluding opinion | |
| 2 | A concluding appraisal with justification | |