CAMBRIDGE
International Education

# Cambridge IGCSE™ (9–1)

**CO-ORDINATED SCIENCES** **0973/31**

Paper 3 Theory (Core) **May/June 2026**

MARK SCHEME

Maximum Mark: 120

**Published**

This mark scheme contains the instructions and marking guidance that our examiners used to mark candidate responses for this component.

Before they start marking, examiners complete a standardisation process. They review a range of candidate responses and discuss the mark scheme in detail to agree which answers can and cannot be accepted. Examiners award marks where it is clear that candidate responses have met the requirements of the mark scheme. These requirements may vary between different components or different versions of the same component, depending on the exact requirements of the question and the candidate responses seen during the standardisation process.

Sometimes, our mark schemes may allow marks to be awarded to responses which contain elements that are factually incorrect or for content not covered by the syllabus. We do this in response to the demands of a specific question to support candidates and make sure that our assessments are fair. However, these allowances should not be used as a guide for teaching and learning.

We cannot discuss the mark scheme with schools, and we recommend that schools read the mark scheme together with the assessment material and the Principal Examiner Report for Teachers.

This document consists of **23** printed pages.

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**[Turn over**

## General marking principles

All examiners must apply these marking principles when marking candidate responses.

| | |
|---|---|
| 1 | Examiners must award marks for each response in line with:<br>• the specific **content** defined in the mark scheme<br>• the specific **skills** defined in the mark scheme or in the level descriptions<br>• the **standard of response** required as exemplified by the standardisation scripts. |
| 2 | Examiners must award **whole marks** (not half marks, or other fractions). |
| 3 | Examiners must award marks **positively**. This means that:<br>• marks are not deducted for errors or omissions<br>• marks are awarded for correct/valid answers as defined in the mark scheme and also for **other valid answers** which go beyond the scope of the syllabus and mark scheme referring to your team leader as appropriate<br>• the quality of spelling, punctuation and grammar are judged **only** when the mark scheme indicates that these features are **specifically assessed** in the question. However, the meaning of all responses must be unambiguous. |
| 4 | Examiners must **consistently** apply the requirements of the mark scheme and any rules for what to do when candidates have not followed instructions correctly. |
| 5 | Examiners must use the **full range of marks** defined in the mark scheme, unless limited by the quality of the candidate responses seen. |
| 6 | Examiners must award marks according to the mark scheme and **must not** award marks with grade thresholds or grade descriptions in mind. |

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**Science-Specific Marking Principles**

| | |
|---|---|
| 1 | Examiners should consider the context and scientific use of any keywords when awarding marks. Although keywords may be present, marks should not be awarded if the keywords are used incorrectly. |
| 2 | The examiner should not choose between contradictory statements given in the same question part, and credit should not be awarded for any correct statement that is contradicted within the same question part. Wrong science that is irrelevant to the question should be ignored. |
| 3 | Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection). |
| 4 | The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted. |
| 5 | <u>'List rule' guidance</u><br><br>For questions that require ***n*** responses (e.g. State **two** reasons …):<br><br>• The response should be read as continuous prose, even when numbered answer spaces are provided.<br>• Any response marked *ignore* in the mark scheme should not count towards ***n***.<br>• Incorrect responses should not be awarded credit but will still count towards ***n***.<br>• Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should **not** be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response.<br>• Non-contradictory responses after the first ***n*** responses may be ignored even if they include incorrect science. |

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| | |
|---|---|
| 6 | <u>Calculation specific guidance</u><br><br>Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states 'show your working'.<br><br>For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values.<br><br>For answers given in standard form (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient ($a$) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.<br><br>Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme. |
| 7 | <u>Guidance for chemical equations</u><br><br>Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.<br><br>State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme. |

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## Annotations guidance for centres

Examiners use a system of annotations as a shorthand for communicating their marking decisions to one another. Examiners are trained during the standardisation process on how and when to use annotations. The purpose of annotations is to inform the standardisation and monitoring processes and guide the supervising examiners when they are checking the work of examiners within their team. The meaning of annotations and how they are used is specific to each component and is understood by all examiners who mark the component.

We publish annotations in our mark schemes to help centres understand the annotations they may see on copies of scripts. Note that there may not be a direct correlation between the number of annotations on a script and the mark awarded. Similarly, the use of an annotation may not be an indication of the quality of the response.

The annotations listed below were available to examiners marking this component in this series.

## Annotations

| Annotation | Meaning |
|---|---|
| ✓ | correct point or mark awarded |
| ✗ | incorrect point or mark not awarded |
| BOD | benefit of the doubt given |
| FT | follow through |
| NBOD | benefit of doubt was considered, but the response was decided to not be sufficiently close for benefit of doubt to be applied. |
| TV | response is too vague or there is insufficient detail in response |
| ECF | error carried forward applied |
| ^ | information missing or insufficient for credit |
| ? | unclear response |
| I | incorrect or insufficient point ignored while marking the rest of the response |

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| Annotation | Meaning |
|---|---|
| R | incorrect point or mark not awarded |
| LNK | two statements are linked |
| SEEN | point has been noted, but no credit has been given or blank page seen |
| ● | key point attempted / working towards marking point / incomplete answer / response seen but not credited / blank page seen |
| BP | blank page |

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**Mark Scheme Abbreviations**

| | |
|---|---|
| ; | separates marking points |
| / | separates alternative responses for the same marking point |
| **A** | accept (a less-than-ideal answer which should be marked correct) |
| **I** | ignore (mark as if this material was not present) |
| **R** | reject the response |
| **AND** | indicates that two or more parts of a response are required for the mark |
| **AVP** | alternative valid point |
| **AW** | alternative wording (where responses vary more than usual) |
| **NOT** | indicates an incorrect response that would contradict another otherwise correct alternative |
| **OR** | alternative responses for the same marking point |
| **owtte** | or words to that effect |
| underline | actual word given must be used by candidate (grammatical variants excepted) |
| **ecf** | error carried forward |
| **ORA** | or reverse argument |
| ( ) | the word / phrase in brackets is not required but sets the context |
| **max** | indicates the maximum number of marks |

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| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 1(a)(i) | brain ; | 1 | |
| 1(a)(ii) | P Q S ; ;<br><br>2 correct = 1 mark<br>all 3 correct = 2 marks | 2 | **Note:** if names given in correct order: receptor, sensory neurone, motor neurone = 1 mark max |
| 1(a)(iii) | **any two from:**<br>protein synthesis ;<br>cell division ;<br>growth ;<br>passage of nerve impulses ;<br>maintenance of body temperature ;<br>active transport ;<br><br>AVP ; | 2 | **I** muscle contraction / movement (in question stem)<br><br>**A** mitosis<br>**A** cell growth<br><br>**A** homeostasis / thermoregulation<br><br>e.g. tissue repair / metabolic reactions<br>**I** digestion / pumping<br>blood / reproduction / breathing / excretion<br>**I** respiration |
| 1(b)(i) | automatic ;<br>rapid ; | 2 | Accept any indication of correct answer e.g. circling / underlining but ticking takes precedence<br>If three ticks, two correct = 1 mark<br>If four or more ticks = 0 marks |
| 1(b)(ii) | drug ; | 1 | Accept any indication of correct answer e.g. ticking / underlining but circling takes precedence<br>More than one circled = 0 marks |

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| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 1(c) | **any 2 characteristics with linked description**<br><br>movement ;<br>action (by an organism or part of an organism) causing change in position / place ;<br><br>respiration ;<br>chemical reactions in cells that break down nutrient molecules / chemical reactions in cells that release energy (for metabolism) ;<br><br>growth ;<br>**permanent** increase in, size / dry mass ;<br><br>reproduction ;<br>(processes that) make more (of the same kind) of organism ;<br><br>excretion ;<br>removal of waste products (of metabolism) / removal of substances in excess of requirements ;<br><br>nutrition ;<br>taking in of materials for, energy / growth / development ; | **4** | Mark for description is dependent on the characteristic<br>**A** correct description without name<br>**A** moves to another place / to move around<br><br>**A** word / symbol equation / correct description of chemical reaction<br><br>**I** getting bigger<br><br>**A** production of offspring / create new/next generation<br>**I** create more species / idea of pass on genes to next generation / make baby<br><br>**I** egestion<br>**R** removal of undigested food / faeces<br><br>**A** nutrients / food for materials<br>**A** metabolism for energy |

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| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 2(a) | **all** nutrients / **all** food groups / AW ;<br><br>in the, correct/appropriate/healthy, amount/proportion / AW; | 2 | **A** all seven nutrients named (carbohydrates, proteins, fats vitamins, minerals, water and fibre) / each food group / each nutrient<br>**I** all foods / the different food groups<br>**A** in the right amount<br>**A** to provide suitable amount of energy for level of activity / lifestyle / to meet and not exceed the needs of the body<br>**I** equal portions |
| 2(b)(i) | **any two from:**<br>cereals / vegetables / fruits ; | 1 | two correct answers needed for the mark |
| 2(b)(ii) | (use of relevant data) 338 g **AND** 90 g / 248 g ;<br>(country) B is 4 / 3.75 times bigger / (country) B is **much** more ; | 2 | **Note** units must be used once for MP1<br>**A** (country) B eats **too** much (meat)<br>**Note** B is, 4 / over 3, times bigger / country B is eating 248 g more meat = 2 marks |
| 2(b)(iii) | low(er) fruit/ vegetable values / intake / **ORA** ;<br><br>(fruit and vegetables) contain vitamin C ; | 2 | **A** numerical comparison of fruit / vegetables e.g. 129 g more or 168 g more or 297 g more<br>**R** if other food groups given for MP1<br>**A** country **A** lacking vitamin C / lack of vitamin C causes scurvy<br>**A ecf** incorrect food group for MP2 |
| 2(c) | carbon, hydrogen, nitrogen, oxygen ; | 1 | all four needed for 1 mark<br>**A** C, H, N and O<br>**I** sulfur<br>**R** if additional substances given |
| 2(d) | egestion ; | 1 | **A** egested **I** descriptions of egestion<br>**R** excretion / exgestion |

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| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 3(a) | large (surface) area ;<br><br>to absorb as much (sun)light as possible ;<br><br>**OR**<br><br>thin ;<br>allows (sun)light to penetrate / short diffusion distances ; | **2** | **Note** accept points anywhere in response / explanation mark can be given without correct adaptation<br>**A** flat / broad<br>**I** big / wide unqualified<br>**A** increase / more photosynthesis due to light / more room for light absorption<br>**I** more space for photosynthesis / more photosynthesis unqualified / attract sunlight<br><br>**A** maximum absorption of sunlight |
| 3(b) | cuticle ;<br>chloroplast ;<br>osmosis ;<br>xylem ;<br>guard cell ; | **5** | |
| 3(c) | oxygen ;<br>diffusion ; | **2** | **A** $O_2$ **I** just 'O' |

| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 4(a) | continuous ; | **1** | **A** genetic / genes |
| 4(b)(i) | mutations ;<br>alleles ; | **2** | |

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| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 4(b)(ii) | **any two from:**<br>(made from) protein ;<br>involved in metabolic reactions ;<br>(biological) catalyst ; | 2 | **I** involved in digestion<br>**A** speeds up reactions / lowers activation energy |
| 4(c)(i) | **any two from:**<br>(water) pollution ;<br>removal of water for drinking / agriculture ;<br>drainage to make space for housing / agriculture ;<br>climate change / lack of rainfall drying up rivers / lakes ;<br>AVP ; | 2 | **I** introduction of non-native species / fishing unqualified<br>**A** description of pollution e.g. contamination / trash<br>**A** drainage of water<br>**A** area used for building / urban expansion **I** just building houses<br>**A** global warming / water temperature increase e.g. building of dams / hydroelectric power stations / underwater mining / trawler or drag-net fishing |
| 4(c)(ii) | *idea of* pupfish better adapted to conditions / pupfish outcompetes / **ORA** ; | 1 | **A** only pupfish can survive in high temperatures / extreme pH<br>**A** non-native fish enzymes cannot function in high temperature / extreme pH<br>**I** non-native species die unqualified<br>**I** comments relating to just the 'fish' |

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| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 4(c)(iii) | decreases (biodiversity) ;<br><br>there are fewer different species ; | 2 | <br><br>**A** idea of loss of other species in the food chain / extinction of other species<br>**I** loss of food for other species in food chain / changes in population / less genetic variation |

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| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 5(a) | **process** / **description**<br>chromatography — a method used to separate an insoluble solid from water<br>diffusion — a method using a burette to mix an acid with an alkali<br>filtration — a technique used to separate mixtures of soluble coloured substances<br>fractional distillation — the result of the constant random motion of particles<br>titration — used in the separation of petroleum into useful fractions<br><br>5 correct = 4 marks<br>3 or 4 correct = 3 marks<br>2 correct = 2 marks<br>1 correct = 1 mark | **4** | **R** if more than one line from any word or definition |
| 5(b)(i) | time taken for reaction to finish /s: 200, 100, 50<br>reaction number: 3, 2, 1 | **1** | All three in correct order needed for mark<br><br>**A** large medium small<br>**A** 1 5 20 |



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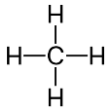
| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 5(b)(ii) | 1.9 ($cm^3$ / s) ; | **1** | **A** 2 (with no indication of d.p.)<br>**A** 1.92<br>**R** 2.0 |
| 5(b)(iii) | take less time / shorter time ; | **1** | **A** decreases / finishes faster / time for reaction is faster<br>**I** just 'faster'<br>**I** faster rate of reaction / reaction speeds up |
| 5(c) | carbon is a non-metal / non-metals form acidic oxides ; | **1** | **A** formed from a non-metal<br>**A** basic oxides made from metals **and** carbon is a non-metal<br>**I** carbon dioxide is a non-metal / reacts with water to form an acid |
| 5(d)(i) | metallic to non-metallic ; | **1** | **A** metallic character decreases |
| 5(d)(ii) | 2 ; | **1** | **A** diagram if answer line blank |

| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 6(a) |  <br>one C–H bond shown ;<br>all correct ; | **2** | **A** correct dot and cross diagram for max 1 including bonding electron pairs<br><br>**Note** H must be **only** bonded to C for MP1<br>**R** if multiple different displayed formula are shown |
| 6(b) | covalent ; | **1** | |
| 6(c) | (saturated have) no (C=C) **double** bonds / **only** (C–C) **single** bonds / **ORA** ; | **1** | **I** (saturated) has maximum number of hydrogen<br>**I** references to number of bonds<br>**A** saturated do not react with bromine turning it colourless and unsaturated do |



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| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 6(d)(i) | (g) **and** (g) **and** (g) ; | **1** | All three needed for mark |
| 6(d)(ii) | exothermic ; | **1** | **A** oxidation<br><br>**I** combustion / burning |
| 6(e)(i) | global warming / climate change ; | **1** | **A** enhanced greenhouse effect / increased greenhouse gases / increased global temperatures / increased atmospheric temperatures<br>**A** consequences of these e.g. rising sea levels / melting glaciers / ice caps / extreme weather / increased sea temperatures<br>**I** higher temperatures unqualified |
| 6(e)(ii) | reduce livestock farming ; | **1** | **A** capture methane from decomposition and use as fuel / reduce landfills / eat less meat from farming / use less manure as fertiliser / use anaerobic digesters / reduce (methane) gas leaks / photocatalysis<br><br>**I** decrease use of fossil fuels / chemical conversion / collect and store methane / decreasing combustion of methane / fossil fuels / less farming unqualified |
| 6(f) | elements **and** compounds **and** elements ; | **1** | |

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| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 7(a) | A – melting<br>B – boiling / evaporating<br>C – condensing<br>D – freezing / solidifying<br>; ;<br><br>4 correct = 2 marks<br>2 or 3 correct = 1 mark | **2** | |
| 7(b) | the water is not pure / **AW** ; | **1** | **A** it is a solution / the water contains, dissolved substances / impurities / the water contains salt<br>**I** because of salt / pure water melts at 0 °C<br>**R** it is not water |
| 7(c) | removes solids / insoluble material ;<br><br>removes tastes / odours / **AW** ;<br><br>kills microbes / pathogens ; | **3** | **A** remove rocks / debris / sediments<br>**R** filters<br>**A** removes organic pollutants / removes chlorine<br>**A** filter for remove<br>**A** kills microorganisms / bacteria<br>**A** disinfects / sterilises<br>**I** get rid of / remove microbes |
| 7(d) | blue ;<br>(to) pink ; | **2** | **A** light blue / dark blue **R** blue-black |
| 7(e) | oxygen ; | **1** | **A** $O_2$<br>**I** air |
| 7(f) | hydrogen **and** oxygen ; | **1** | either order<br>**A** $H_2$ **and** $O_2$ |

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| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 8(a) | 4 × 16 **or** 2 × 1 seen ;<br>98 ; | **2** | Correct answer on answer line = 2 marks<br>**I** units |
| 8(b)(i) | X – oxygen ;<br>Y – hydrogen ; | **2** | **A** $O_2$<br>**A** $H_2$<br>**Note** both gases wrong way round = 1 mark |
| 8(b)(ii) | cathode ; | **1** | |
| 8(b)(iii) | carbon / graphite / platinum ; | **1** | |
| 8(c)(i) | any number 1 – 4 inclusive ; | **1** | **A** below 7 |
| 8(c)(ii) | magnesium + sulfuric acid → magnesium sulfate + hydrogen<br><br>hydrogen ;<br>all else correct ; | **2** | **A** reactants in either order and products in either order<br>**Note** if no attempt at word equation accept $H_2$ for MP1 and accept symbol equation if all formulae correct and balanced for MP2. If both words and symbols given, ignore symbols |
| 8(c)(iii) | copper / silver / gold ;<br>below **hydrogen** in reactivity series ; | **2** | **A** platinum<br>**A** less reactive than hydrogen<br>**I** unreactive unqualified / low in reactivity series |

| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 9(a)(i) | any two from:<br>**A**, **C**, **D and E** ; | **1** | Both needed for 1 mark<br>**A** names of the power stations e.g. geothermal, hydroelectric, tidal, wind<br>**A** solar / waves |
| 9(a)(ii) | **B** ; | **1** | **A** fossil fuel<br>**A** named fossil fuels |
| 9(b) | (nuclear) <u>fission</u> ; | **1** | **R** fusion |

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| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 9(c)(i) | *idea that* 116 ÷ 29 = 4 **or** 4 half-lives **or** 2.0 × ½ × ½ × ½ × ½ ;<br>0.125 (g) ; | **2** | Correct answer on answer line = 2 marks<br>**A** 0.13 (g) |
| 9(c)(ii) | –1 / (single) negative (charge) ; | **1** | **A** $^{0}_{-1}e$ |
| 9(c)(iii) | one **neutron** into one **proton** and one **electron** ; | **1** | All three words required for the mark<br>proton and electron in either order |
| 9(c)(iv) | alpha **and** gamma ; | **1** | **A** $\alpha$ **and** $\gamma$ |
| 9(d) | in lead(–lined) container / in concrete / deep underground ; | **1** | **I** in nuclear bunker / far away from people |

| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 10(a)(i) | R ; | **1** | |
| 10(a)(ii) | acceleration is caused by a **resultant force** ; | **1** | **A** need a resultant force to accelerate / resultant force is not zero / forces are unbalanced if Q is larger than S the overall net forward force is greater<br>**A** net forward force for resultant force<br>**I** forces do not cancel out / references to direction as a result of forces |
| 10(a)(iii) | *W* = *mg* (in any form) **or** (mass =) 2 500 000 ÷ 9.8 ;<br><br>260 000 (kg) ; | **2** | Correct answer on answer line = 2 marks<br><br>**A** 255 102.0408<br>**Note** where working shown **A** use of *g* = 10 e.g. *g* = 10 or formula and substitution for MP1 then **ecf** 250 000 for MP2 |



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| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 10(a)(iv) | total area = 14 × 0.050 ($m^2$) **or** 0.70 ;<br>pressure = force ÷ area (in any form) **or** (pressure =) 2 500 000 ÷ 0.70 ;<br><br>3 600 000 (N / $m^2$) ; | **3** | Correct answer on answer line = 3 marks<br>**I** units for MP1<br>**A ecf** if wrong area calculated but used correctly e.g. 2 500 000 ÷ 0.050<br>**I** pressure = mass ÷ area / *F* = *ma*<br><br>**A** 3 571 428.571<br>**A ecf** from wrong area if working shown e.g. 50 000 000 |
| 10(b)(i) | 195 / 1000 × 60 × 60 **or** 702 seen ; | **1** | **A** 195 × 3.6 |
| 10(b)(ii) | speed = distance ÷ time (in any form) **or** (*t* =) 5400 ÷ 702 ;<br><br>7.7 (hours) ; | **2** | Correct answer on answer line = 2 marks<br>**A** (*t* =) 5400 / 700<br><br>**A** 7.6923<br>**A** if 700 used 7.7142<br>**A** 8 (without d.p.) |

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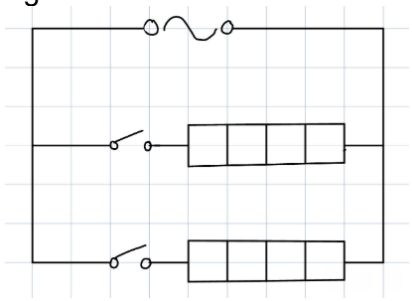
| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 11(a)(i) | correct symbols for ac power supply **and** switch **and** heater ;<br>parallel connection for heaters ;<br>two switches in correct positions ; | **3** | e.g.<br>  <br>**I** small gaps in circuit<br>**A** symbol seen once for MP1<br>**A ecf** two switches in parallel with two of the same component for MP2 e.g. bulb<br>**Note** symbol in MP must be correct for MP2 and MP3. If series circuit only MP1. |
| 11(a)(ii) | 25 Ω ;<br>resistance is less than either of individual resistances ; | **2** | If incorrect resistance indicated = 0 marks<br>**A** resistance is half value of either of individual resistances / correct substitution in equation<br>**I** 50 ÷ 2 / parallel lowers overall resistance |
| 11(b)(i) | conduction ;<br>convection ; | **2** | |
| 11(b)(ii) | 100 (°C) ; | **1** | |
| 11(b)(iii) | (water =) B **and** (steam =) C ; | **1** | Both needed for the mark |
| 11(c) | steel is magnetised more slowly / steel loses magnetism more slowly / **ORA** ; | **1** | **A** steel forms permanent magnets but iron does not / steel magnet lasts longer<br>**I** references to the strength of magnetic fields / stronger emf / steel magnet more durable |

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| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 11(d) | density = mass ÷ volume (in any form) **or** $0.60 \div 7.6 \times 10^{-5}$ ;<br><br>7900 (kg / $m^3$) ; | 2 | Correct answer on answer line = 2 marks<br><br>**A** 7895 / 7894.7<br>**I** 8000 |

| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 12(a)(i) | visible light ;<br>infrared ; | 2 | **I** just visible |
| 12(a)(ii) | damage to (skin) cells / damage to eyes / (skin) cancer ; | 1 | **A** damage to DNA / premature aging / cataracts / immune system suppression / sunburn / skin burn / mutation<br>**I** skin irritation / harm / damage to skin |
| 12(a)(iii) | detecting fake bank notes / AVP ; | 1 | **A** forensic photography / examples of forensic use e.g. detecting fingerprints / air purification / sterilisation / glue/nail polish hardening / fluorescent effects / sunbeds / treating cancer<br><br>**I** in nail salon unqualified / check for stains unqualified / tanning |
| 12(a)(iv) | ultraviolet next to X-rays ; | 1 | **A** UV for ultraviolet<br>**Note** if no other indication accept tick or X in box |
| 12(b)(i) | (amplitude =) 0.2 (m) ;<br>(wavelength =) 4 (m) ; | 2 | |

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| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 12(b)(ii) | energetic ;<br>surface ; | **2** | **A** energised / energy<br>**I** active / faster<br>**I** top |

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