**Component 1 mark scheme – 1DT0/1D**

**Section A – Core content**

| Question number | Answer | Mark |
|---|---|---|
| **1 (a) (i)** | Any **one** property from:<br><br>• hard (1)<br>• durable (1)<br>• close grained (1)<br>• tough (1)<br>• non-toxic materials (1) | **(1)** |

| Question number | Answer | Mark |
|---|---|---|
| **1 (a) (ii)** | Any **one** property from:<br><br>• good heat insulator (1)<br>• absorbs odours (1)<br>• soft (1)<br>• maintains body heat / warmth (1) | **(1)** |

| Question number | Answer | Mark |
|---|---|---|
| **1 (a) (iii)** | Any **one** property from:<br><br>• good heat insulator (1)<br>• very good impact resistance (1)<br>• semi-rigid (1) | **(1)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **1 (a) (iv)** | Any **one** property from:<br><br>• ductile (1)<br>• malleable (1)<br>• good conductor of heat (1)<br>• corrosion resistance (1)<br>• waterproof (1)<br>• compressive / tensile / bending strength (1) | Do **not** accept unqualified response in relation to strong or strength. | **(1)** |

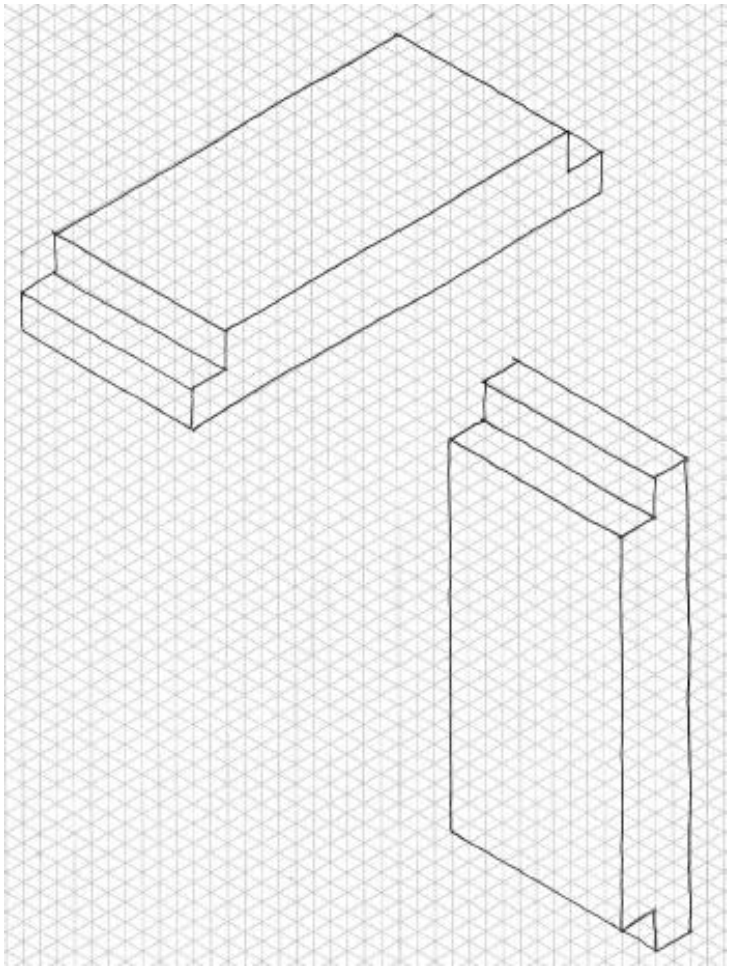
| Question number | Answer | Mark |
|---|---|---|
| **1 (b)** | Any **one** explanation that includes a disadvantage (1) and a linked justification of that disadvantage (1).<br>• It could give you an electric shock if you touched a bare wire / connection (1) which could result in a burn / electrocution (1)<br>• There might be a power cut (1) which results in power loss / lights out / loss of computer data (1)<br>• Not available in remote / rural areas (1) so it reduces accessibility (1) | **(2)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **1 (c)** | A calculation that includes:<br>• correct working (1)<br>• correct answer to whole number (1)<br>Method:<br>$\frac{5.69-1.12}{5.69}$ x 100 (1)<br>80% (1) | Award full marks for correct numerical answer without working.<br>Allow for ECF if candidate gets part of calculation wrong. | **(2)** |

| Question number | Answer | Mark |
|---|---|---|
| **2 (a)(i)** | **One** name from:<br>• eccentric (1)<br>• circular (1) | **(1)** |

| Question number | Answer | Mark |
|---|---|---|
| **2 (a)(ii)** | Any **one** description that includes an accurate statement about movement of the bird (1) and a linked justification of that statement (1).<br>• The bird will pivot / rotate around the axle (1) like a pecking motion (1)<br>• The bird will rock backwards and forwards (1) as the follower goes up and down (1) | **(2)** |

| Question number | Answer | Mark |
|---|---|---|
| **2 (a)(iii)** | Any **one** explanation that includes an effect of change in the cam (1) and a linked justification of that effect (1).<br><br>• The bird will rise gently (1) before dropping suddenly (1) | **(2)** |

| Question number | Answer | Mark |
|---|---|---|
| **2 (b)** | An isometric drawing that includes an image drawn with a ruler or free hand. Marks to be awarded for the following.<br><br>• Accurate setting out of the straight edges to the correct shape (1)<br>• Correct height (1)<br>• Correct width (1)<br>• Correct dimensions of the rebate (1)<br><br>  | **(4)** |

| Question number | Answer | Mark |
|---|---|---|
| **3 (a)** | Any **one** property from:<br><br>• durable (1)<br>• hard wearing (1)<br>• abrasion resistance (1)<br>• tear resistance (1) | **(1)** |

| Question number | Answer | Mark |
|---|---|---|
| **3 (b)** | Any **one** explanation that includes a reason for batch production (1) and a linked justification of that reason (1).<br><br>• The supply of old pairs of jeans might be limited (1) therefore the incoming supply of raw materials may restrict the level of production (1)<br>• Their ability to sell large levels of stock might be limited (1) therefore they would not want to manufacture stock they could not sell (1)<br>• The workshop capacity may be limited (1) allows other products to be produced by the company (1)<br>• Less storage of raw materials (1) so saving space (1) | **(2)** |

| Question number | Answer | Mark |
|---|---|---|
| **3 (c)** | Any **one** explanation that includes an advantage of government funding for new business start-ups (1) and a linked justification of that advantage (1).<br>• The interest rates are likely to be lower / fixed (1) which means it is a cheaper way to borrow money / fund the start-up in comparison to a traditional bank loan (1)<br>• Business mentors are often associated with government backed loans (1) who can provide valuable guidance and assistance in the early stages of a new business (1)<br>• The business owner does not have to find a guarantor (1) making it easier for people from different backgrounds to start a business (1) | **(2)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **3 (d)** | A calculation that includes:<br><br>correct working (1)<br>correct answer to nearest whole number (1)<br><br>Method:<br><br>144 x $10^6$ x 1.08 x 1.08 = 1.679616 million / 1.679616 (1)<br><br>£170 million (1) | Award full marks for correct numerical answer without working.<br><br>Allow for ECF if candidate gets part of calculation wrong. | **(2)** |

| Question number | Answer | Mark |
|---|---|---|
| **3 (e)** | Any **two** explanations that includes a reason for using renewable energy sources (1) and a linked justification of that reason (1).<br>• Renewable energy sources help to reduce a factory's carbon footprint (1) therefore it gives the factory 'greener' credentials / saves finite resources (1)<br>• Once the factory has paid for the installation costs (1) the energy used is free / reduces operating costs (1)<br>• The factory / unit might be in an area that cannot be connected to a National grid supply (1) therefore it is only possible to use an alternative supply such as renewable sources which will be available (1) | **(4)** |

| Question number | Answer | Mark |
|---|---|---|
| **4 (a)(i)** | Any **one** explanation that includes a valid reason for using aluminium (1) and a linked justification of that reason (1)<br><br>• Aluminium is malleable (1) which means it can be pressed into shape easily without tearing / ripping / edges folded over the keep the lid in place (1)<br>• Aluminium is ductile (1) which means it can be formed / rolled out into long thins sheets ready to be pressed into shape (1)<br>• Aluminium has a high lustre surface finish / shiny (1) and will reflect the heat of the hot food / retain the heat inside the container (1)<br>• Aluminium is inert (1) and therefore will not contaminate the food (1)<br>• Aluminium is relatively light weight (1) and therefore does not add unnecessary weight (1)<br>• Aluminium is waterproof (1) and therefore stops any liquid seeping through the package (1) | **(2)** |

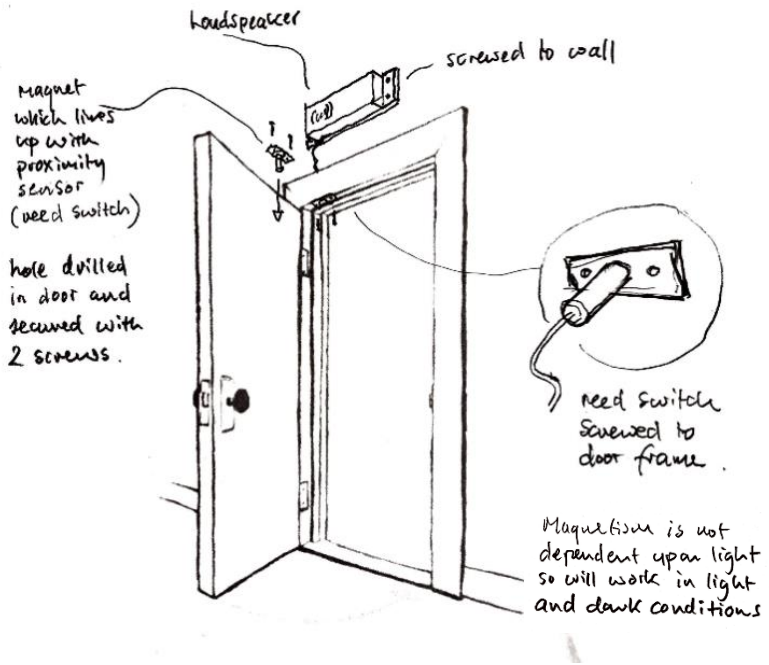
| Question number | Answer | Mark |
|---|---|---|
| **4 (a)(ii)** | Any **one** explanation that includes an advantage of using solid white board (1) and a linked justification of that advantage (1)<br><br>• Excellent surface finish (1) which means it can be printed on / branded with a company's logo (1)<br>• Can be coated / have a foil back applied to it (1) which means the heat will be reflected / retained within the food container (1)<br>• It is a rigid / quite stiff material (1) which means the foil container can be folded down onto / over the lid without it bending / flexing retains the shape of the container (1)<br>• Lid can be die cut in bulk (1) reducing costs (1) | **(2)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **4 (b)** | A calculation that includes:<br><br>Correct working (1)<br><br>Calculation of correct ratio 18:38 (1)<br><br>Method:<br><br>22 / 56 x 18 = 7.071429 million tonnes (1)<br>= 7.07 million tonnes (1) | Award full marks for correct numerical answer without working.<br><br>Allow for ECF if candidate gets part of calculation wrong. | **(2)** |

| Question number | Indicative content | Mark |
|---|---|---|
| **4 (c)** | • The environmental damage caused to the landscape / countryside in China will be huge<br>• Energy consumption will be high in China as the process requires a lot of energy / related pollution issues<br>• Transportation of aluminium around the world<br>• Europe does not produce any aluminium and so they have to import / jobs / transport costs / pollution<br>• Countries could be encouraged to recycle more rather than to make aluminium from new / energy dependent<br>• Companies could be encouraged to recycle / more / financial incentives paid for scrap aluminium | **(6)** |

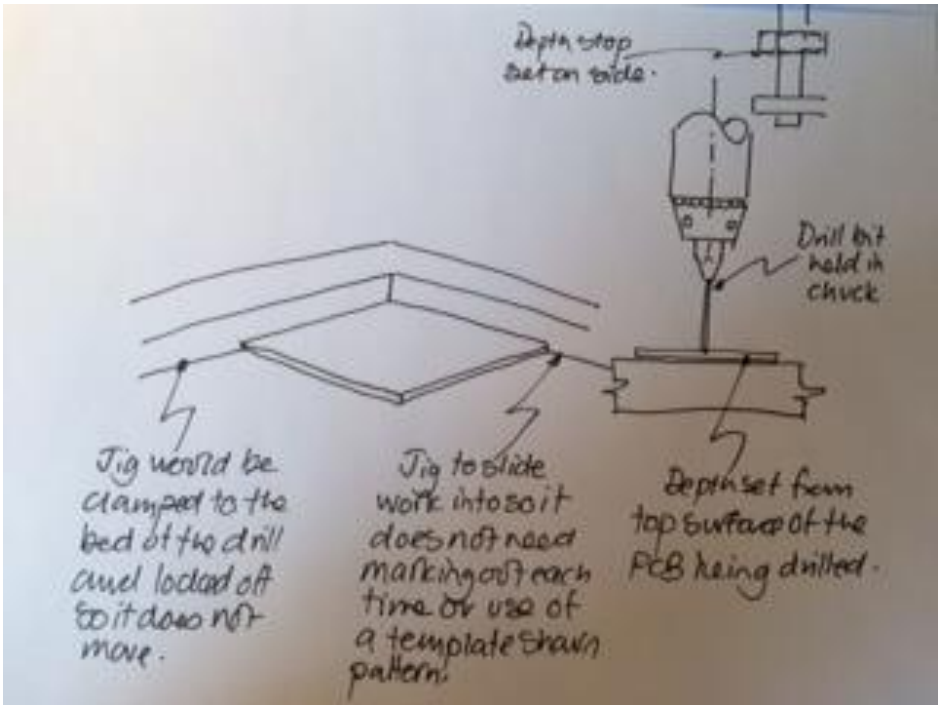
| Level | Mark | Descriptor |
|---|---|---|
| | 0 | |
| Level 1 | 1 - 2 | • Attempts to interrogate and deconstruct information but connections and logical chains of reasoning are flawed.<br>• An unbalanced appraisal of the information/issues, containing judgements that show a limited awareness of the interrelationships between factors or competing arguments. |
| Level 2 | 3 – 4 | • Interrogates and deconstructs information and provides some connections and logical chains of reasoning.<br>• A balanced appraisal of the information/issues, containing judgements that show an awareness of the interrelationships between factors or competing arguments. |
| Level 3 | 5 - 6 | • Interrogates and deconstructs information and provides sustained connections and logical chains of reasoning.<br>• A well-balanced appraisal of the information/issues, containing judgements that show a thorough awareness of the interrelationships between factors or competing arguments. |

**Section B – Systems**

| Question number | Answer | Mark |
|---|---|---|
| 5 (a) | **Marks will be awarded for understanding of design and technology, not graphical skills.**<br><br>Notes and/or sketches that include:<br><br>• be able to sense when the door is open and closed (1) during light and dark conditions (1)<br>*e.g. micro-switch / PTM switch / piezoelectric sensor / reed switch (1) an explanation as to how or why they are not dependant on light (1)*<br>• have an audible method (1) of alerting the owner (1)<br>*e.g. loud speaker, buzzer, siren, electro-mechanical bell (1) that could be heard in different parts of the house (1)*<br>• be securely attached (1) and removeable (1)<br>*e.g. recessed hole / attached to frame or door (1) temporary fix with screws (1)*<br>*(could be applicable to either the input or the output transducer or both)*<br><br>Example of candidate response.<br>  <br><br><br>Annotated notes:<br>Replace LDR with suitable sensor in relation to the situation<br>Replace LED with audible output and explanation in relation to the situation<br>Screw/fix sensor to frame<br>Screw/fix sensor to door | (6) |

| Question number | Answer | Mark |
|---|---|---|
| **5(b)** | Any **two** explanations that include a way (1) and a linked justification of that way (1).<br>• The two cubes have different numbers on all the faces (1) so as they are rotated round they show the correct two numbers for the specific date (1)<br>• The long block at the bottom shows the month of the year (1) and as the month changes the block is simply rotated (1)<br>• It might be a bit confusing to work out what the date number is (1) because of the numbers being shown on the top of the cubes (1) | **(4)** |

| Question number | Answer | Mark |
|---|---|---|
| **6 (a)** | Any two advantages (1) and a linked justification (1)<br><br>• Smaller components / lower profile / much higher component density / double sided boards (1) so PCB/product size can be reduced / more efficient use of material (1)<br>• Fewer holes need to be drilled (1) increasing space for routing / fewer operations (1)<br>• Completely automatic (1) fewer technicians required (1)<br>• Better mechanical performance under shake and vibration conditions (1) so product is more durable / withstands vibration (1)<br>• Lower resistance / inductance (1) consequently, fewer unwanted RF signal, therefore less chance of interference / improved performance (1) | **(4)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| 6 (b) | **Marks will be awarded for understanding of design and technology, not graphical skills.**<br><br>Notes and sketches that include:<br><br>• Putting / securing the drill bit in the chuck / chuck key (1)<br>• The clamping / setting up of the work /potential use of templates / jigs / depth (1)<br>• Setting up the depth stop on machine or drill bit (1)<br>• Securing to the bed of the machine to ensure it will not move (1)<br><br>  <br><br><br>Annotated notes:<br>Depth stop set on the side. Drill bit held in chuck. Work secured in a machine vice. Depth set from top surface of the PCB being drilled. Jig to slide work into so it does not need marking out each time or use of a template show pattern. Jig would be clamped to the bed of the pillar drill and locked off so it does not move. | Do not accept anything related to the drilling process itself. Do not accept anything related to the use of cordless or hand drills. | **(4)** |

| Question number | Answer | Mark |
|---|---|---|
| **6 (c)** | Any **one** explanation that includes a reason for using sleeving (1) and a linked justification for that reason (1).<br><br>• Encases/covers bare wires (1) to prevent short circuits / electric shocks (1)<br>• Strengthens connections / reduces strain on joints/connectors (1) reduces faults / disconnected components (1)<br>• Reduces problem of tangled wires (1) making fault finding/repair easier (1) | **(2)** |

| Question number | Answer | Mark |
|---|---|---|
| **6 (d)** | Any **two** explanations that include a method (1), plus **two** linked justifications of that method (1) + (1).<br>• It could be 3D printed (1) allowing the designer to include ribs/variable wall thickness/more detail (1) which means minimal material is required to form the shape/adds strength to the design (1)<br>• The top could be made from laser cut panels (1) which can cut the outline and different holes (1) removing the need to change tools/drill holes (1)<br>• CNC milling machine could be used (1) to cut from a solid block (1) reducing the need for further assembly operations (1)<br>• Named hand processes could be used (1) resulting in individual pieces being cut (1) freeing up machines for other operations (1) | **(6)** |

| Question number | Answer | Mark |
|---|---|---|
| **7 (a)** | One country that produces crude oil given from:<br>Russia / Saudi Arabia / USA / Iraq / Iran / China / Canada / UAE/ Kuwait / Brazil (1) | **(1)** |

| Question number | Answer | Mark |
|---|---|---|
| **7 (b)** | Any **two** explanations that include a reason (1) plus a linked justification for the reason (1)<br>• Denser coverage (1) produces sharp/clear image/more attractive colours (1)<br>• More durable bond (1) less likely to scratch off over time (1)<br>• High quality edge definition (1) as inks will not bleed/leak/run/drip (1) | **(4)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **7 (c)** | A calculation that includes:<br><br>• Conversion of units<br>• Calculation of flat surface area of two large sides<br>(85 x 30 x 2 = 5,100) (1)<br>• Calculation of semi-circular surface area<br>(15 x 15 = 225 x 3.142 = 706.95 x 2 / 2 = 706.95) (1)<br>• Calculation of surface area on the edges<br>(85 x 10 x 2 = 1,700)<br>(30 x 10 = 300)<br>(2 x 3.142 x 15 x 10/2 = 471.3)<br>(Total = 2,471.3) (1)<br>• Total surface area calculation for 100 pieces<br>(5,100 + 706.95 + 2,471.3) x 100 = 827,825mm$^2$ or 0.8278m$^2$(1)<br>• Calculation of volume<br>(1,000 / 12 x 0.8278 = 68.99 ml) (1) | Do not award the final mark if the final answer is in litres.<br><br>Award full marks for correct numerical answer without working.<br><br>Allow ecf if candidate gets part of calculation wrong. | **(5)** |

| Question number | Answer | Mark |
|---|---|---|
| **7 (d)** | Any two explanations that includes a working property (1), plus two linked justifications of that working property (1) + (1).<br><br>• More energy efficient than other light sources (1) reduces energy consumption over time (1) therefore power supplies last longer (1)<br>• Small / compact sizes (1) enables them to fit into the USB stick (1) without interfering with the original function of the product / case design (1)<br>• Longer lasting than other light sources (1) will not need to be replaced as often (1) reducing costs in the long term (1)<br>• Run at lower temperatures (1) therefore are safer to use (1) because cases will not heat up/overheat (1)<br>• Available in a range of colours (1) allowing versatility of product range (1) which means they can be customised for different brands and companies (1) | **(6)** |

| Question number | Answer | Mark |
|---|---|---|
| **8 (a)(i)** | Any **one** explanation that includes a reason (1) and a linked justification of that reason (1).<br><br>• The laptop can be customised to appeal to different ages / genders / cultures (1) therefore increasing potential sales (1)<br>• A standard laptop can be mass-produced (1) which means limited editions / batches can be created with the addition of different coloured skins (1)<br>• It is easily replaced (1) if it becomes scratched or damaged (1)<br>• It provides an extra layer of protection (1) by absorbing any impact / abrasion (1) | **(2)** |

| Question number | Answer | Mark |
|---|---|---|
| **8 (a)(ii)** | Any **one** explanation that includes a working property (1), plus **one** linked justification of that property (1) + (1).<br>• Relays are electrically isolated (1) and act as an electro-magnetically operated switch/switches on the motor (1) which allows the use of separate power supplies (1)<br>• Connects circuits of different voltages (1) so that higher powered devices can be controlled (1) therefore primary circuit components are completely protected (1)<br>• Acts as an interface between a primary and secondary circuit (1) so that the heater is powered by 12v (1) the primary circuit is protected (1)<br>• It converts electrical to kinetic energy (1) acting as an electrically operated switch (1) so the secondary circuit can be operated indirectly by the microcontroller (1) | **(3)** |

| Question number | Answer | Mark |
|---|---|---|
| **8 (b)** | Any **two** explanations that includes an advantage (1) and a linked justification of that advantage (1).<br><br>• Production can be easily adjusted (1) therefore its simple to switch between different products/produce customised circuits/responds quickly to design changes (1)<br>• Pick and place technology will simply repeat the program, time after time (1) therefore all PCBs will be identical (1)<br>• Surface Mount Technology/SMT/smaller components can be used (1) allowing for smaller PCBs/more compact circuits/less material used (1)<br>• Pick and place technology will operate 24/7 (1) therefore productivity output will be high and will meet levels of consumer demand (1) | **(4)** |

| Question number | Indicative content | Mark |
|---|---|---|
| 8 (c) | **AO3 (9 marks)**<br>**Arguments should address the following areas:**<br><br>• Suitable for less developed countries, enabling access to education, health, disaster relief services and the internet<br>• Suitable for use by outdoor workers (such as Antarctic exploration teams/campers/travellers/remote workers) where there is no power grid available<br>• Rugged design suitable for children where the laptop may receive rough handling<br>• It is increasingly important to have access to the internet for work/leisure irrespective of the location<br>• Enables the user to be always connected<br>• The rugged/stylish look may appeal to user groups, such as outdoor enthusiasts<br>• Eco-friendly solar power source may appeal to some environmentally conscious users<br>• The main materials can all be recycled to reflect the requirements of the WEEE regulations<br>• Outer skins can be customised with graphics to reflect current trends and fashions<br>• The World Wide Web/software applications are becoming more and more popular across all parts of the globe<br>• Wireless/satellite connection technologies are becoming increasingly popular allowing people to communicate more freely<br>• Sustainability as a concept is becoming increasingly popular | **(9)** |

| Level | Mark | Descriptor |
|---|---|---|
| | 0 | |
| Level 1 | 1 - 3 | • Attempts to interrogate and deconstruct information but connections and logical chains of reasoning are flawed.<br>• An unbalanced appraisal of the information/issues, containing judgements that show a limited awareness of the interrelationships between factors or competing arguments.<br>• A conclusion may be presented but it is likely to be generic assertions rather than supported by relevant judgements. |
| Level 2 | 4 – 6 | • Interrogates and deconstructs information and provides some connections and logical chains of reasoning.<br>• A balanced appraisal of the information/issues, containing judgements that show an awareness of the interrelationships between factors or competing arguments.<br>• A conclusion is presented that is partially supported by relevant judgements. |
| Level 3 | 7 - 9 | • Interrogates and deconstructs information and provides sustained connections and logical chains of reasoning.<br>• A well-balanced appraisal of the information/issues, containing judgements that show a thorough awareness of the interrelationships between factors or competing arguments.<br>• A conclusion is presented that is fully supported by relevant judgements. |