Pearson Edexcel

Mark Scheme (Results)

Summer 2024

Pearson Edexcel GCSE
In Design & Technology (1DT0)
1C: Polymers

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

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Component 1 mark scheme

Section A – Core content

Question number	Answer	Mark
1 (a) (i)	Any **one** property from: • Soft / softness (1) • Absorbent / absorbs water (1) • Insulator of heat / thermal insulator (1)	**(1)**

Question number	Answer	Mark
1 (a) (ii)	Any **one** property from: • Sets rigid / rigid (1) • Hard / scratch resistant (1) • Transparent (1) • Non-toxic / skin safe (1)	**(1)**

Question number	Answer	Mark
1 (a) (iii)	Any **one** property from: • Smooth surface (1) • Printability / takes colour / ink / toner well (1) • Absorbent (1) • Opaque (1) • Flexible / flexibility (1)	**(1)**

Question number	Answer	Mark
1 (a) (iv)	Any **one** property from: • Hard (1) • Tough (1) • Fine grain / close grain / even texture (1) • Non-toxic / food safe (1) • Good heat resistance / thermal insulator / low thermal conductor (1)	**(1)**

Question number	Answer	Additional guidance	Mark
1 (b) (i)	Any **one** advantage of using cast iron for the frying pan (1) and a linked justification of that advantage (1) • It is a good conductor of heat (1) therefore the pan surface gets hot quickly / will transfer heat to the food to cook it (1) • It is dense / heavy (1) therefore it will be quite stable on the oven top / unlikely to get knocked over easily (1) • It has good dimensional stability when heated (1) therefore the pan will not distort / buckle (1) • It holds the heat well (1) therefore meaning it stays hot for some time / longer (1) • It has a high melting point (1) therefore it can withstand the temperatures involved in cooking (1)	Do not accept anything related to melting	**(2)**

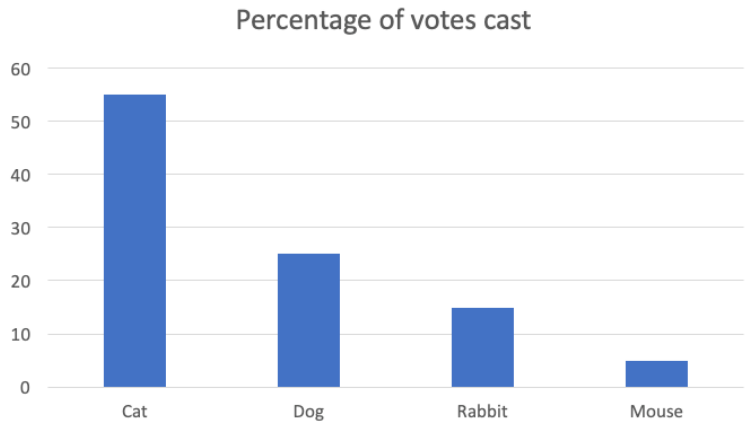
Question number	Answer	Additional guidance	Mark
1 (b) (ii)	A calculation that includes: • correct conversion of units 3 kg = 3000 grams (1) • correct answer 3000 x 2/100 = 60 grams (1) If no conversion of units: 3 x 2/100 = 0.06 grams (worth 1 mark)	Award full marks for correct numerical answer / correct numerical answer without working. Conversion of units could be done after the percentage calculation. Allow for ECF if candidate gets part of transposition wrong.	**(2)**

Question number	Answer	Additional guidance	Mark
2 (a)	Any **one** specific animal fibre from: • Wool (1) • Silk (1) • Mohair (1) • Horsehair (1) • Cashmere (1) • Angora (1) • Alpaca (1)	Do not accept plant fibres, e.g. cotton / cotton wool	**(1)**

Question number	Answer	Mark
2 (b)	Any **one** advantage of using biofuels (1) and a linked justification of that advantage (1) • Biofuels are a renewable / sustainable source of energy (1) which means there will always be a supply / not run out / reduce the rate at which conventional fuels are being used (1) • Less carbon emitted when burnt as fuel (1) which reduces pollution levels / emissions by the delivery vehicles (1) • Biofuels are relatively carbon neutral / smaller carbon footprint (1) which means the absorption of CO^2 during growth is almost equal to the emissions produced when being burnt (1)	**(2)**

Question number	Answer	Mark
2 (c)	Any **one** advantage of using CAD (1) and a linked justification of that advantage (1) • Colour / texture / grain / render can be added to the design (1) which means a realistic image is produced / able to see what it looks like / accurate visual representation (1) • Changes can be easily made (1) which means client feedback can be considered / design modified (1) • Files / part files can be output direct to CNC machines (1) which means prototypes can be produced quickly / reduce lead times to full production runs (1) • Files can be saved electronically (1) which means they can be sent to client / manufacturer as an email attachment (1) • Designs can be sent via email (1) which means stakeholders can provide immediate feedback (1) • Images / views can be manipulated / rotated / zoomed-in (1) which means the ideas can be seen from any angle / intricate details seen up close (1) • Design can be seen in 3D (1) which means thickness / proportions can be accurately represented / seen (1)	**(2)**

Question number	Answer	Additional guidance	Mark
2 (d) (i)	A calculation that includes: • correct calculation for the number of votes cast for the Rabbit (165 / 55) * 15 = 45 (1) • correct calculation for the number of votes cast for the Mouse • (165 / 55) * 5 = 15 (1) • Alternative method for second mark 300 – 165 – 75 – 45 = 15	Correct numerical answers only for full marks. Award full marks for correct numerical answers without working.	**(2)**

Question number	Answer	Mark
2 (d) (ii)	A completed bar chart that shows the two correct bars for the Rabbit at 15% and the Mouse at 5%: 	**(2)**

Question number	Answer	Mark
3 (a)	Award **one** mark from: • V-belt (1) • Vee belt (1) • V-shaped (1) • Vee shaped (1)	**(1)**

Question number	Answer	Mark
3 (b)	Any **one** reason for using aluminium rather than mild steel for the pulley (1) and a linked reason for the use (1) • Aluminium is a non-ferrous metal (1) therefore it will not rust if it comes into contact with water (1) • Mild steel is a ferrous metal / contains iron (1) therefore it is likely to rust / corrode (1) • Aluminium is lighter / less dense than mild steel (1) therefore it will have less of an impact on the weight of the boat / quicker to get up to speed (1) • Aluminium has a lower melting point than mild steel (1) which makes it easier / cheaper to cast (1) • Aluminium is softer than mild steel (1) which means it is easier to machine / turn on a lathe (1)	**(2)**

Question number	Answer	Mark
3 (c)	A calculation that includes: • Correct transposition of the formula Output speed = input speed / velocity ratio (1) • Correct calculation of output speed in rpm 2000 / (5/1) = 400 rpm (1)	**(2)**

Question number	Answer	Mark
3 (d)	Any **one** disadvantage of using the solar cell to power the motor (1) and a linked justification of the disadvantage (1) • The sun might not be bright enough / blocked by clouds (1) which means the boat could stop / get stranded in the middle of a lake / pond (1) • The solar cell might not be capable of providing the power required (1) which means the motor will not turn / turn fast enough to make the boat move (1) • A battery / storage system may be required to store electrical charge (1) which means an increase in weight in the boat hull / make the boat heavier / slower to move through the water (1) • Will not work in low light / dark (1) which means limited use in winter / late at night (1)	**(2)**

Question number	Answer	Mark
3 (e)	Any **two** benefits of using balsa wood to manufacture the frame for the model boat (1) and a linked justification of that benefit (1) • It is lightweight (1) making it easier to power with the solar cell (1) • It is soft (1) which means it is easy to cut with a sharp knife / sand to a smooth curve shape / form / work with (1) • It has a low density / buoyant material (1) which means it will float on the water / not sink (1)	**(4)**

Question number	Answer	Mark
4 (a)	Any **two** explanations that reference the way in which conductive inks can be used in products (1) and a linked justification of each way (1) • They can be used to draw / repair electronic circuits (1) which reduces the need for wires / soldering / expensive / dangerous chemicals to be used to make circuits / PCBs / can be drawn on flexible materials (1) • They can be used as antenna / wireless aerials in car windscreens (1) which means cars can have uninterrupted Wi-Fi connectivity / connected to internet for live traffic data / electric charging points (1) • They can be used to create interactive wall / visual displays / products (1) which means when parts of the wall / products are touched / connected electronic outputs are made to work / light up / move / sound (1) • They can be applied using a pen / printer / silk screen printed (1) which means circuits can be produced to decorate fashion / textiles garments / embed electrical components (1) • They reduce the need for dedicated circuit boards (1) which reduces product weight / useful in restricted spaces (1) • Conductive inks will bend / flex (1) therefore they will move without breaking / cracking (1)	**(4)**

Question number	Answer	Additional guidance	Mark
4 (b)	A calculation that includes: • correct working out of weight (40/100) x 9 or 9 x 0.4 (40 x 9) /100 (1) • correct answer 3.6 grams (1)	Award full marks for correct numerical answer without working. Allow for ECF if candidate gets part of calculation wrong.	**(2)**

Question number	Indicative content	Mark
4 (c)	• Designers should consider / try to use fewer materials when designing new products / developing new technology so as to minimise the impact on the natural resources available • Designers should try to use as many recyclable materials as possible to reduce the need for new / virgin grade materials • Products / technology should be lighter therefore costing less to transport / distribute post manufacture • Fewer toxic materials / processes should be used therefore causing less damage to the environment during / post use / less to be taken into account when disposing of the item / recycling • The carbon footprint of the product / technology should be considered so that minimal impact on the environment can be made / use locally available materials / less transportation • LCA should be carried out during the design process to make sure that the product / technology can be assessed in terms of its carbon footprint • Consideration should be given to the origin of the raw materials in terms of mining for minerals / oil exploration / cutting down of trees / mining for ore • Designers should try to use biodegradable materials if possible / appropriate • Carry out research into new / emerging materials to assess environmental impact / carbon footprint • Designers could make use of standardised parts / modular components • Designers create products that are easily dismantled / disassembled / repaired allowing materials / parts to be recycled / reused	**(6)**

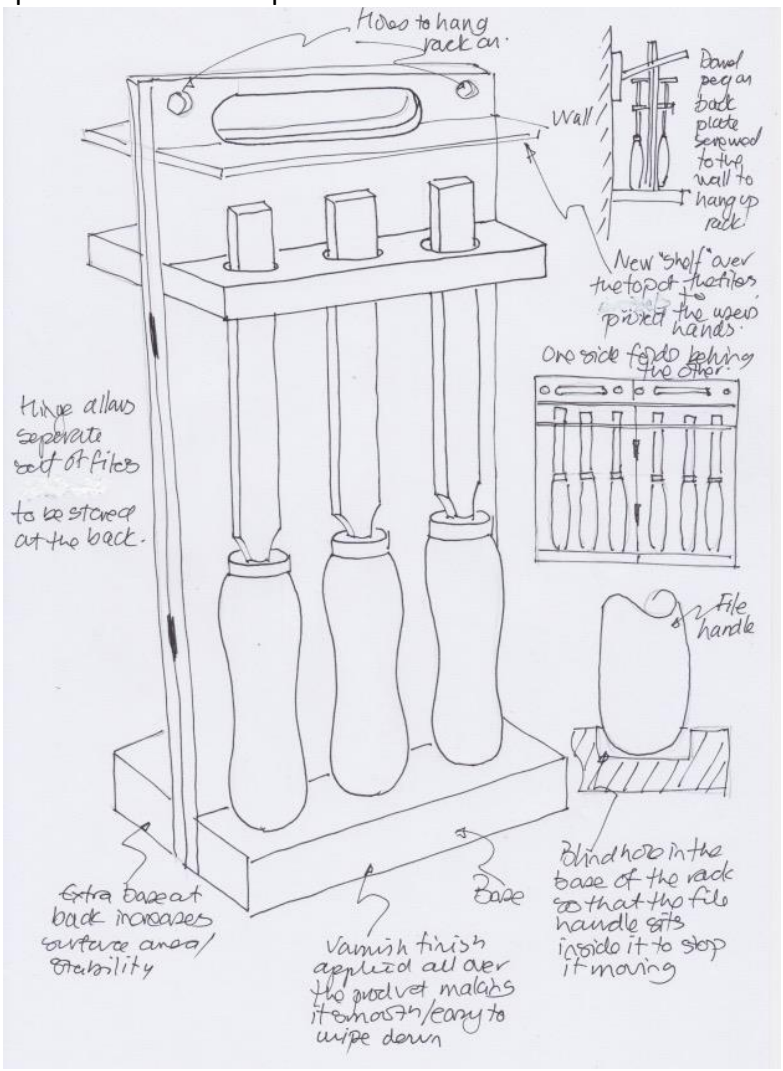
Level	Mark	Descriptor
	0	
Level 1	1 - 2	• Attempts to interrogate and deconstruct information but connections and logical chains of reasoning are flawed. • An unbalanced appraisal of the information/issues, containing judgements that show a limited awareness of the interrelationships between factors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

		• 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 – Polymers

Question number	Answer	Mark
5 (a)	**Marks will be awarded for understanding of design and technology, not graphical skills.** Notes and sketches that include: • be able to hold an additional three files (1) and stop the handles of the files from moving as the rack is carried around a workshop (1) e.g. extra three holes / slots alongside / longer / double sided (but not at the expensive of being able to hang it up on a wall) / blind hole for butt of file / frame around it to hold it in place / spring clip • protect the user from potential scratches when carrying the rack (1) and have a surface finish that is easy to clean (1) e.g. shelf over the top edge of the files / file edge covers / hinged flap / varnish / waxed / painted • be more stable when placed on a bench (1) and be capable of being hung up on a wall (1) e.g. wider base / triangular back supports / holes to hang it up on / dowels to go through carrying handle to allow hanging on the wall / nails / screws / pegs in the wall **See next page**	**(6)**

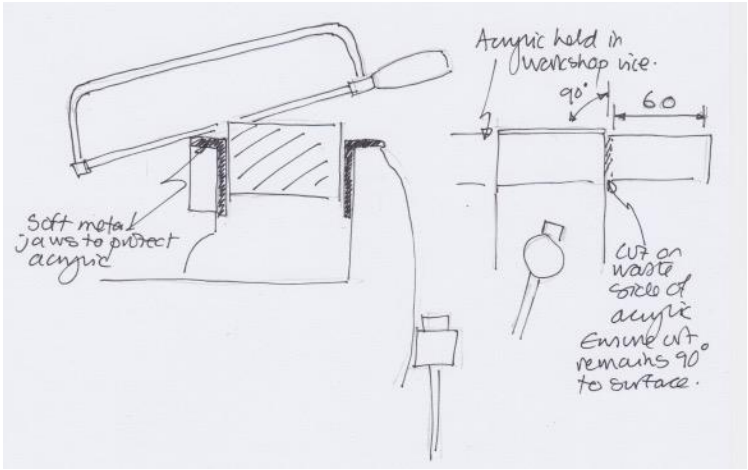
Example of candidate response:



Notes:
Holes to hang rack
Dowel peg on back plate screwed to the wall to hang up rack
New 'shelf' over top of files to protect the users' hand
One side folds behind the other
Hinges allow separate set of 3 additional files to be stored at the back
Extra base at the back increases surface area / stability
Varnish finish applied all over the product to make it smooth / easy to wipe down
Blind hole in the base of the rack so that the file handle sits inside it to stop it moving

Question number	Answer	Mark
5(b)	Any **two** explanations that include a way the polymer food play set meets or fails to meet the requirement (1) and a linked justification of that way (1) • You can cut the fruit in half with the toy knife (1) therefore the child is able to see what the fruit looks like on the inside / simulates preparing a healthy meal (1) • There are several different fruits (1) therefore there is quite a lot to be able to discuss with parents about the types of fruits / some have to be peeled to be eaten / others just eaten (1) • There are only fruits shown / featured in the set (1) therefore it only provides a narrow range of healthy foods / discussion points (1)	**(4)**

Question number	Answer	Mark
6 (a)	Any **two** explanations for manufacturing the house from acrylic (1) and a linked justification (1) • Acrylic is capable of being buffed to achieve a glossy lustre (1) which means that the light from the candle will shine / reflect from the surface (1) • Acrylic comes in a range of colours (1) which means that no additional surface finishing / colouring needs to take place (1) • Acrylic is available in a translucent / fluorescent / transparent form (1) which means the lighting effect will be more dramatic (1) • Acrylic is easy to wipe clean (1) which means no special cleaning products required (1)	**(4)**

Question number	Answer	Additional Guidance	Mark
6 (b)	**Marks will be awarded for understanding of design and technology, not graphical skills.** Notes and sketches that include: • Place acrylic in the vice / on a bench hook (1) • Use of sacrificial timber / aluminium / protective jaws to protect the acrylic being cut (1) • Small cuts at the start on the waste side to get the cut going (1) • Check / ensure cut is being made vertical down the marked line (1) • Progress the cut all the way down / slowing down at the end (1) Example of candidate response:  Notes: Acrylic held in workshop vice Soft metal jaws to protect the acrylic Cut on waste side of acrylic Ensure cut is 90^0 to the surface	Cap at 3 marks if no sketches or all sketches and no notes	**(4)**

Question number	Answer	Mark
6 (c)	Any **one** explanation of a surface finish or treatment (1) and a linked justification for that reason (1) • Acrylic can be etched / engraved with a laser (1) which means that any text / number will be physically burnt into the surface (1) • Vinyl can be cut out on a plotter / cutter (1) which means stickers can be applied to the surface with transfer tape (1) • A stencil can be made / used (1) which means spray paint / paint can be applied (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) Cutting / sawing / use of a saw (1) • An adjustable / coping saw can be used to cut along the lines whilst the work is held in a vice (1) which means the triangular sections would be removed as whole pieces (1) Machine sanding / sanding / abrading (1) • The work could be held against a band facer / sanding machine to remove the waste (1) leaving a very smooth surface finish (1) Filing (1) • A file could be used at an angle to remove small amounts of polymer whilst the work is held in a vice (1) which results in a flat surface (1) Milling (1) • A chamfer cutter is held in a milling machine chuck / CNC milling machine chuck (1) which means the waste would be removed by a fast turning cutter / made with several passes to leave a smooth edge (1)	**(6)**

Question number	Answer	Mark
7 (a)	• Triangulation / triangulate / triangulating (1) • Brace / braced / bracing (1) • Diagonal member (1) • Strut / struts / strutted (1)	**(1)**

Question number	Answer	Mark
7 (b)	Any **two** working properties of HIPS explained (1) plus a linked justification of the property (1) • HIPS has good plasticity when heated (1) which means that it is capable of being bent / shaped to form over a former / mould required to make the tray shape / will set stiff / rigid in shape as it cools (1) • HIPS has good impact strength (1) which means that it can take the shock / impact of magazines being dropped into it (1) • HIPS is lightweight (1) which means it will not add unnecessary weight to the product if picking up to move around (1)	**(4)**

Question number	Answer	Additional guidance	Mark
7 (c)	A calculation that includes: • Calculation of the length of the semi-circle (1) $\pi D/2 = \pi$ (2 x 9) / 2 = 28.278 cm • Calculation of the total length of the part required (1) 28.278 cm + (2 x 16) = 60.278 cm • Calculation of how many whole strips can be cut from long length of the sheet (1) 244 / 30 = 8 • Calculation of how many whole strips can be cut from width of the sheet (1) 122 / 60.278 = 2 • Calculation of the number of whole pieces that can be cut from a single sheet (1) 8 x 2 = 16 pieces Alternative method from Step 3 (Step 1 and 2 same as above) • Calculation of small sheet area 60.278 x 30 = 1808.34 cm^2 (1) • Calculation of total sheet area 244 x 122 = 29768 cm^2 (1) • Calculation of number of sheets 29768 / 1808.34 = 16.46 rounded to 16 (1)	Award full marks for correct numerical answer without working. Allow ecf if candidate gets part of calculation wrong.	**(5)**

Question number	Answer	Mark
7 (d)	Any **two** explanations that include a benefit of using nut and bolt joints to join the frame and the tray (1), plus **two** linked justifications of that benefit (1) + (1) • The fixing method is a non-permanent fixing (1) which means if any parts get broken they can be replaced (1) therefore extending the life of the product (1) • The nuts, bolts and washers can be in different colours / styles (1) which means they can be made to stand out / made a design feature (1) therefore improving the visual appeal of the product / aesthetics of the product (1) • Nuts and bolts need little or no skilled operative knowledge to assemble the rack (1) which means it's cheaper for the manufacturer (1) therefore the cost of the rack is reduced (1) • Can be sold as a flat pack (1) which means overall package size is smaller (1) therefore reducing waste packaging material / warehouse storage space (1)	**(6)**

Question number	Answer	Mark
8 (a)	Any **one** explanation that includes an advantage of using expanded polystyrene (1) and a linked justification of that advantage (1) • Expanded polystyrene is lightweight (1) which means that it will not weigh the swimmer down in the pool / water (1) • Expanded polystyrene is a buoyant material (1) which means it floats in water / will help to keep the wearer afloat in water (1)	**(2)**

Question number	Answer	Mark
8 (b)	Any explanation of using a standard thickness material for the swimming aid (1) plus **two** linked justifications of that advantage (1) + (1) • Fewer different sizes of materials have to be bought (1) which means less money tied up in stock / more readily available (1) therefore providing better cash flow for the company (1) • Machines can be set up to cut / process the one thickness of material (1) which means no changes need to be made / fewer machine changes (1) therefore reducing manufacturing time / costs (1)	**(3)**

Question number	Answer	Mark
8 (c)	Any **two** explanations that includes a way that the expanded polystyrene has been cut (1) and a linked justification (1) • The shapes will be cut to a standard / exact rectangular size (1) which means that they will all be the same size / ready to have the corners cut off (1) • A hole will be cut into the rectangular sections (1) which means that they will be able to be threaded onto the waist belt / strap (1) • The material has been cut with a serrated edge / blade / knife (1) against a guide / fence to ensure dimensional accuracy (1)	**(4)**

Question number	Indicative content	Mark
8 (d)	Impact on **cost factors** in relation to: • Expanded polystyrene is a buoyant material due to the foam like structure which means it contains lots of air bubbles which means it floats therefore taking less raw material because air is introduced • The material would have to be tested to ensure that it is non-absorbent / does not soak up any water which could mean that some material be rejected with costs being absorbed by the original material supplier • The material would need to be tested to ensure it met the standards required to be used as swimming aids / ensure it was buoyant enough which could mean that some material be rejected with costs being absorbed by the original material supplier • The material would need to be cut to shape, making sure it was of the correct size to give the buoyancy required which means if it were too small the material would be wasted and if it were too big it would add an extra cost • The holes cut in the material would need to be the correct size to ensure that each block did not move along / around on the belt which means any that were cut to the wrong size would be wasted • No surface treatments would be required as the material will be coloured / textured during manufacture which removes the need for a surface finish • Surface treatments could be applied in the form of printed images / words on it so that it could be customised for schools / swimming clubs • Batch production allows for economies of scale, reducing the cost per unit as the production volume increases	**(9)**

Level	Mark	Descriptor
	0	
Level 1	1 - 3	• Attempts to interrogate and deconstruct information but connections and logical chains of reasoning are flawed. • An unbalanced appraisal of the information/issues, containing judgements that show a limited awareness of the interrelationships between factors or competing arguments. • 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. • A balanced appraisal of the information/issues, containing judgements that show an awareness of the interrelationships between factors or competing arguments. • 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. • A well-balanced appraisal of the information/issues, containing judgements that show a thorough awareness of the interrelationships between factors or competing arguments. • A conclusion is presented that is fully supported by relevant judgements.