



GCSE EXAMINERS' REPORT

GCSE DESIGN AND TECHNOLOGY

SUMMER 2019

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DESIGN AND TECHNOLOGY

GCSE

Summer 2019

COMPONENT 1: DESIGN AND TECHNOLOGY IN THE 21ST CENTURY

General Comments

A new, broader and more demanding examination paper this year that was accessed well by many candidates. A number of centres had prepared candidates well for the new structure of examination paper by referring and using the specimen paper during Year 10, delivering the specification in a systematic topic by topic basis. By doing so students were well prepared for the changes to the examination paper and performed well in all questions and all material areas; centres need to be commended for preparing their students so well.

However, it was evident that other centres had not taught fully the new specification as the core knowledge of a range of commonly used materials was not evident in the answers provided by a number of candidates. The examination paper will always include images of products and so it would be advantageous to the candidates if centres incorporated brief product analysis exercises into their lessons which would allow candidates to become familiar with a broad range of products, and the properties of materials that they are made from. The compulsory maths, new to this specification, initially worried centres, but the majority of students, from all ability levels, accessed these questions without concern. The only area that centres need to spend more time on is calculations within the electronic systems section of the specification.

The in-depth sections were managed quite well, in particular the analysis and evaluative questions. It seemed candidates had experience of answering this style of question and understood the importance of giving both positive and negative view points. It was pleasing to see nearly all candidates answering just one question 6.

Although questions often follow a theme, candidates must read the stem of each question carefully, they do, at times, duplicate the same points throughout the paper. Answers in material questions were sometimes vague, lacking real knowledge of the materials particularly chosen for specific products. Examples of "it's strong", "it's cheap", "it's comfortable", are not encouraged unless supported by a fact that can elaborate or explain why. Examples of supported answers are given in the mark scheme so centres are encouraged to use this as a teaching tool and while reading the feedback that follows.

Comments on individual questions/sections

Q.1 Lifecycle of Products

A positive start to the paper whereby the majority of candidates performed extremely well, a number achieving full marks.

- (a) The mathematics questions were answered correctly by nearly all candidates. It was good to see candidates reading the question well and analysing the data given. If answers given were incorrect it was often found the working method was correct so some marks were still gained.

The majority of candidates gave a simplistic definition of 'carbon footprint'. Some candidates need to offer more detail in their responses and be aware this is required for questions needing an explanation.

- (b) It became clear the Product Life Cycle had been taught well in centres, many candidates could explain with ease what occurs during the decline stage. Those candidates who found this question challenging did use/refer to the diagram, helping them gain a mark. Candidates are very familiar with environmental concerns surrounding product design materials so those who attempted the question on the impact landfill has on the environment did well.

Q.2 Materials Technology

Some excellent responses were seen to these smart and modern material questions though there were a number of candidates who struggled to pick up marks or gave very simplistic descriptions.

- (a) Very few candidates fully knew Rhovyl is used in sports wear because of its anti-bacterial property. However, candidates used their knowledge of sportswear to consider the required properties of the material and so all who attempted this question wrote a sound description.
- (b) Candidates did show an understanding of the key properties of both Nomex and Kevlar but many found it difficult to explain with clarity why they are blended together. It is advisable that centres don't always teach materials in isolation and use products that do combine/blend materials to help improve performance and function.
- (c) Not as many candidates as it was hoped achieved well with the understanding of the action of Polymorph pellets. It can only be concluded that some candidates had not been introduced to polymorph as a material and had not had the opportunity to heat it in warm water and manipulate it.
- (d) Many candidates chose a thermochromic product to show their understanding of how it can be used in named products to offer a sign of danger. Some explained well how thermochromic materials can highlight danger but not all gave a product example which formed part of the stem of the question.

Q.3 Electronic Systems, Programmable Components and Mechanical Devices

A challenging section of the paper for many candidates. Understanding the roles of, and the differences of microprocessors and microcontrollers was limited although these were the very high graded questions in the paper. This was the one section of the paper where candidates didn't even attempt to answer some of the questions.

- (a) Most candidates identified with ease the power source and the switch in the circuit diagram provided. Some candidates confused LDRs with solar powered lighting, highlighting the need to read carefully the stem of the question. Many candidates understood the role of LDRs but confused the role of resistance when the light levels were low or high.
- (b) In general, candidates found the calculations of Mechanical Advantage and Velocity Ratio very challenging. Those who did have an understanding – having practised these calculations it is assumed – achieved success.

Many candidates stated the fulcrum's role is one of a pivoting nature and then went on to identify the mechanical advantage would change as a result of a change in position of the fulcrum.

- (c) Very few candidates scored well, most struggled to identify the functions and therefore differences between a microprocessor and microcontroller. A large number of candidates failed to pick up any marks in these sections of the paper. Those candidates who did answer this question often got the roles of each mixed up. Stand-alone lessons will be needed to ensure students do have a basic understanding of the roles of each for possible future examination papers.

Q.4 Materials

- (a) This starter question was surprisingly challenging for some candidates. Ensuring students can identify the name of materials that are commonly abbreviated is recommended.
- (b) The majority of candidates understood how corrugated cardboard is structured and answered this question with ease. Being a 'state' question, simple, one-word answers were accepted.

Some candidates just described the disadvantages of corrugated cardboard without referring to its use when model making. Ensuring candidates highlight the stem of the question may help them in future gain full marks.

Most candidates managed to identify a suitable metal for the saucepan but few identified an appropriate thermosetting plastic for the handle. Some candidates stated 'metal' and 'plastic' as an answer. If the question is asking for a material example, we need candidates to be specific with the answer given and not to give generic answers.

- (c) Another starter question that many candidates did not answer correctly, this was surprising as Medium Density Fibreboard is such a common material used in schools.

Many candidates could name a piece of CAM equipment used to create the pattern but not all could confidently explain why MDF was used for the radiator cover. Teaching candidates the characteristics as well as properties of the most common materials used in product design is advisable for this question which does commonly focus on the properties of such materials. It was good to see candidates writing in full sentences attempting to discuss and give supporting comments on the properties of MDF. This style of question does not require 4 properties when the marks awarded are four, we require candidates to justify their answers with supporting comment(s) so this may need further practise in the classroom.

Most candidates could state a suitable finish to improve the aesthetics of the radiator cover but not all explained the benefit of this choice as was the requirement.

- (d) This question was not answered well by many candidates. Wool is the most common of animal polymers and the most common used for a jumper. Many understood the jumper had good insulating qualities but few could explain why or give a descriptive answer.

Textiles is a key material in product design and will have an equal weighting in questions posed in the core of the exam paper.

Q.5 Generic Questions

After question 1, this was the most successfully answered question. The most popular products selected were the fabric bag for life and the drinks carton.

- (a) Nearly all candidates could identify the function of their selected product. Candidates had a good knowledge of material sustainability and answers given to this section of the question were sound.
- (b) Candidates read this question well, gave a good description of both primary and secondary source research and many gave an example, questionnaires being the most common. Full marks were frequently awarded. However, candidates struggled to evaluate ergonomic considerations associated with their chosen product. A number of candidates discussed sustainable issues instead. Incorporating both ergonomic and anthropometric considerations within their NEA projects may help to embed the definitions and the importance of each.
- (c) Many candidates understood the importance of involving the user to develop designs but not all related with clarity to their chosen product. Generally, candidates had a good understanding of commercial manufacture and were able to identify appropriate scales of production.
- (d) A pleasing set of correct maths calculations showing candidates are being taught well functional maths style questions.

Q.6 In-depth Knowledge

Nearly all candidates were able to follow the instructions about selecting and answering just one material area. The most popular materials selected, by far, were timbers and metals; few chose electronic systems or fashion and textiles. Generally, candidates accessed the questions well, scoring highly, thanks mainly to successfully answered maths questions and questions (c) and (d). Many centres had focused their teaching – it appeared – on just one material area and these candidates performed much better than those who had selected a material area of their choice. As with section A, those candidates that had been thoroughly prepared for the exam, covering most aspects of the specification, performed well gaining upwards of 17 marks.

Q.6 Electronic Systems, Programmable Components and Mechanical Devices

- (a) An example of a question that was not always read correctly. Some candidates identified a production process rather than a construction method. Many also referenced vacuum forming (which is not a suitable method to commercially manufacture the robotic vacuum cleaner) rather than injection moulding. Despite this confusion most candidates gained full marks for outlining the advantages of using injection moulding and could name a suitable thermoplastic with an advantage for this product.

All candidates had an understanding of how flow charts are used to communicate processing. Most identified correctly the two missing processes to gain 2 marks though not all candidates were able to use reasoning to select and place the decision statements in the correct order.

- (b) All maths calculations were well attempted and the majority answered perfectly, gaining full marks.
- (c) As with all materials, some candidates did confuse the Lifecycle Analysis (which is about the products lifecycle from cradle to grave) with the Product Lifecycle (which is about sales of a product over time). It became clear that the majority of candidates had been taught about the Lifecycle Analysis so discussed confidently the environmental issues associated with extraction and transportation of raw materials, production, packaging and recycling availability. There was a logical chain of reasoning with both positive and negative features included within responses.
- (d) This question, on the benefits of batch production were soundly answered based on candidate's general knowledge. However, a number of candidates' answers veered towards mass production. Ensuring candidates do fully understand the differences between batch and mass production – the advantages and disadvantages – is a recommendation. A consequence was not many gained full marks. It was pleasing to read good structure with an understanding of discussing the positive and negative factors when answering an evaluative question.

Q.6 Papers and Boards

- (a) The majority of candidates stated laser cutting was the method used to cut the shape of the memory sticks. This was awarded the mark even though die cutting was the most appropriate method and the answer we were looking for. Few were able to give advantages that related to manufacturing the memory sticks without glue nor were they able to recognise that debossing was used as a finishing process choosing to explain embossing instead. As a consequence, candidates found it difficult to describe with notes and sketches how the prototypes of the memory stick could be manufactured in a school setting.
- (b) The maths questions were answered really well with many gaining full marks for each section.
- (c) Not all candidates accessed this question fully. All referenced papers are easier to recycle than plastic but they failed to recognise the growing demand for alternatives to plastic products. Consumers are becoming far more aware the impact plastics are having on the environment and so designers and manufacturers are collaborating to find alternatives to fulfil the demand that is emerging, even if costs increase.
- (d) Most candidates achieved at least half marks as they were able to recognise the benefit to workforces in developing countries who manufacture parts of the memory sticks. Advantages (and disadvantages) to manufacturing costs were also highlighted. Few, although some, did manage to explain how governments, and economies benefit from this type of manufacture, driving down price and bringing about healthy competition.

Q.6 Timber and Manufactured Boards

- (a) An example of a question that was not always read correctly. Some candidates identified a production process rather than a construction method. Despite this confusion most candidates gained full marks for outlining the advantages of using birch plywood to manufacture the stool. Outlining the advantages of using CNC machinery to manufacture the stool was also well received with many gaining full marks for this section of the question.

Candidates were able to use notes and sketches really well in describing the stages required to prepare the surfaces of the stool for applying a polyurethane varnish. Some sophisticated illustrations were seen and most illustrations were helping candidates gain maximum marks.

- (b) The maths questions were answered really well with many gaining full marks for each section.
- (c) A few candidates did confuse the Lifecycle Analysis with the Product Lifecycle. These candidates only scored minor marks. However, it became clear that the majority of candidates had been taught about the Lifecycle Analysis so discussed confidently the environmental issues associated with growth/extraction and transportation of raw materials, production and recycling of timber based products. There was a logical chain of reasoning with both positive and negative features included within responses.
- (d) This question, on the benefits of batch production were soundly answered based on candidate's general knowledge. However, a number of candidates' answers veered towards mass production. Ensuring candidates do fully understand the differences between batch and mass production – the advantages and disadvantages – is a recommendation. A consequence was not many gained full marks for this question. It was pleasing to read good structure that showed an understanding evaluative answers ideally need positive and negative factors to be highlighted within written text.

Q.6 Metals: Ferrous and Non-Ferrous Metals

- (a) Most candidates could identify that the fizzy drinks cans were mass produced. In addition, there was some confident answers when discussing the advantages of using aluminium as a material. Candidates had no real problems outlining the advantages of using automated machinery to manufacture the drinks cans. They did struggle however, to describe fully how the shape of the cans helps users to stack them. There was a variety of responses to this question, many included one or two fantastic sketches but these were not always supported with detailed written responses.
- (b) The maths questions were answered really well with many gaining full marks for each section.
- (c) A few candidates did confuse the Lifecycle Analysis with the Product Lifecycle. These candidates could only score minor marks. However, it became clear that the majority of candidates had been taught about the Lifecycle Analysis and so discussed confidently the environmental issues associated with the extraction and transportation of raw materials, production, packaging and recycling of the product.

There was a logical chain of reasoning with both positive and negative features included within responses. Full marks were gained by some candidates. It was particularly pleasing to see answers well-structured and composed.

- (d) Candidates demonstrated a very good understanding of the benefits to continuous flow production; a number being awarded full marks. It is worth emphasising to candidates that evaluative responses do benefit from including both advantages/benefits and disadvantages/limitations. If they remember this then full marks may be easier to gain.

Q.6 Thermoforming and Thermosetting Polymers

- (a) Not all candidates were able to identify compression/press moulding or injection moulding as the process used to construct the rotor blades. It was felt candidates considered how the domed main body was manufactured instead. This emphasises the importance of reading the question fully before answering.

At least one disadvantage of using polypropylene for the main body of the dome was given but a large number of candidates failed to give two appropriate disadvantages.

Candidates did manage to give reasons why plastic laminates are appropriate for the chassis but many failed to explain fully, querying the depth of understanding candidates have about the process of lamination. A number of candidates found it difficult to describe with notes and sketches how they could manufacture the domed main body of the drone in a school setting with detail. Some mentioned the importance of a jig or template and most referenced the use of a vac former and the need for clamps.

- (b) The maths questions were answered really well with many gaining full marks for each section. Those who didn't achieve full marks often gained some marks for correct workings.
- (c) Not all candidates accessed this question fully. All referenced plastics can now be recycled but they failed to hone in on the stem of the question. Designers (due to consumer demand) are now looking for more sustainable ways to design products, whilst manufacturers have to, and are, promoting the ethical approaches they are employing to ensure sales are maintained or increased over time.
- (d) Most candidates achieved at least half marks as they were able to recognise the benefit to workforces in developing countries who manufacture parts of the GPS drone. Advantages (and disadvantages) to manufacturing costs were also highlighted. Few, although some, did manage to explain how governments, and economies benefit from this type of manufacture, driving down price and bringing about competition.

Q.6 Fibres and Textiles

- (a) Approximately 50% of candidates understood an overlocking stitch is used to neaten seams of clothing. This was a disappointing response for a starter question.

Few candidates scored full marks choosing to give reasons associated with fibre content rather than on the knitted construction of the material. The most popular, correct answer given was linked to the comfort of the material. We wanted candidates to recognise knitted fabric stretches and this brings many benefits to children's clothing, notably the fabric can stretch to fit a growing child.

Most candidates were confident in outlining the advantages of using CAM to print onto clothing.

The majority of candidates could use both notes and sketches to describe the process of transfer printing and those that found this question challenging guessed the answer gaining some marks.

- (b) The maths questions were answered really well with many gaining full marks for each section.
- (c) There was a logical chain of reasoning with both positive and negative features included within responses to the Lifecycle Analysis of textile materials. Full marks were gained by some candidates. It was particularly pleasing to see answers well-structured and composed.
- (d) Few candidates demonstrated a clear understanding of cell production within the textile industry. Many answers given were more appropriate in the evaluation of assembly line production. Both advantages and disadvantages were given but some referred to the manufacturers rather than the workforce as was required from the stem of the question.

Summary of key points

The main areas candidates could improve attainment are by:

- Analysing products frequently. Discuss the materials they are made from and why these materials are best suited (or perhaps not) to the product. Familiarity to this type of questioning will benefit candidates for the summer exam.
- Using a highlighter pen to identify the stem of the question. Candidates need to be able to differentiate the differences between describe, explain, analyse and evaluate.
- Practising exam style questions, self or peer assessing each may also help. This should include both basic level responses and those that need a developed response.
- Writing their own exam style questions as each topic is delivered. This will bring about familiarity.
- Ensuring they have an understanding of all material areas, not just those that are used in their NEA.

I hope the feedback provided above will help centres to prepare for the 2020 examination season.

DESIGN AND TECHNOLOGY

GCSE

Summer 2019

COMPONENT 2: NON -EXAMINED ASSESSMENT.

General Comments

This is the first year of the award of this new specification for GCSE Design and Technology. This specification provides centres outside Wales with one GCSE course in Design and Technology examined through EDUQAS.

This year, the qualification weighting has shifted to a 50-50 split in weighting of examination and Non-Examined Assessment (NEA) where the legacy specification awarded controlled assessment project work at 60% of the qualification at. The NEA is worth 100 raw marks.

The new specification clearly requires candidates to present a 'design journey' showing the iterative development of a fully functioning prototype that fully meets the identified needs, wants and values of the users. There is now far more emphasis on a 'think, test, evaluate, rethink' cyclic process where possible design ideas are tested, developed and refined against a clearly defined design specification. The format and layout of the NEA submission is completely flexible, and candidates may present their NEA in a way which best reflects their skills, abilities and expertise. This is a 35-hour design and make task which commences on June 1st annually with the publication of three different contextual challenges.

Comments on individual questions/sections

Assessment Criteria

- **Identifying and investigating design possibilities – 10 marks**

Candidates are required to study the 3 contextual challenges, and investigate, analyse and research these areas in order to be able to identify a range of possible design problems. It is important that this is not done in a linear fashion, and that candidates take ownership over their NEA from the start. There is no single starting point where candidates must begin this, and so candidates should be encouraged to understand problems from the user's perspective.

These 'design problems' can then be further examined, and candidates should develop possible design briefs. It is critical to consider the marking criteria early on during the NEA in order for candidates to be clear about the expectations of the mark descriptors.

All candidates need to establish a clear understanding of the end user's needs, wants and values to fully appreciate the design problem. The 'user centred' design approach cannot be achieved without constant reference to the end user during the whole design journey.

This area was generally assessed fairly and consistently in centres, although sometimes candidates were awarded high marks when they had been quite narrow and focussed on one problem, which fits better with the lower mark ranges.

- **Developing a design brief and specification – 10 marks**

Candidates are required to consider a broad range of possible problems before narrowing down and focussing on one chosen brief. Sometimes lower achieving candidates fail to demonstrate various possible problems, and the design journey they present is rather narrow. The final design brief that candidates choose to tackle should be developed as a result of realistic research and their understanding of the problem is critical to the eventual success of the product, and in the production of an innovative and creative outcome that fully meets the needs, wants and values of the end user.

Design Specification criteria needs to be developed appropriately by candidates so that they can use these as design tools, to ensure critical features are included in design ideas. Sometimes, candidates produce a generic list of basic criteria which do not contain any measurable criteria. These are no useful to candidates, they do not help focus designing, and they make analysis of ideas more difficult because there is nothing to measure success against.

There are a number of successful strategies which candidates can employ to help structure specifications. One is to separate the specification into areas such as size, cost, function, aesthetics etc., and itemise important factors under these headings. Including specific dimensions is useful within the 'size' specification list, so candidates are establishing clear parameters to help generate initial ideas.

Some candidates used dedicated headings such as 'User Needs' and 'User Wants' when developing the specification. This helps to ensure that the target market requirements are an integral part of the design process. Similarly, establishing 'essential' and 'desirable' criteria also helps candidates to include features which are vital, and consider others which are not so critical.

Specifications should be used as a design tool to help evaluate ideas as they develop. Not all candidates demonstrate this reflection of the specification criteria, and as a result do not access the higher mark range.

This area is generally fairly assessed in centres, although sometimes specifications that are not fully developed are awarded high marks.

- **Generating and developing design ideas – 30 marks**

In order for candidates to be able to generate possible initial ideas, they need to have a firm grasp of the problem, and a clear appreciation from the user's perspective. This proves problematic for some, because they do not really know enough about the problem, and therefore cannot take thinking to the next level. Initial ideas are meant to be broad and wide ranging, and candidates should be encouraged to produce ideas directly related to specification criteria. If specifications are detailed enough, issues such as size, function, cost, etc. can simple help to construct ideas. Candidates should be able to utilise a range of design strategies early on to see whether their initial ideas have any potential. Low fidelity modelling (card / foam / mock ups) will serve well as quick and simple ways to test ideas. As ideas develop, candidates should be recording their 'design journey' as they travel through the iterative process of 'think, test, evaluate, re-think'. There should be testing, experimenting and modelling at every level of designing, with analysis and evaluation of this to identify factors for elimination as well as areas for further development, refinement or 'tweaking'. Candidates can photograph testing and modelling, and use this to 'overlay' further ideas, and also present practical modelling outcomes as evidence during moderation. It is critical that candidates demonstrate their 'design journey' and illustrate how they arrive at a final prototype stage.

This area is commonly over rewarded by centres, and candidates' marks are often found to be generous during moderation. Candidates do not need to produce high volume evidence here; it is not the amount of work that allows access to high marks. Candidates need to document what they are testing, the results of the test, and how this impacts on their thinking moving forward. Lean design is encouraged, but it must be focussed, relevant and well-documented.

- **Manufacturing a prototype – 30 marks**

Similarly, the quality and eventual success of the prototype is directly dictated by the detail of the final design and the overall understanding of the design problem. Most candidates produced a timeline for production to demonstrate how they would tackle the manufacture of the final, fully functioning prototype. Most candidates thoroughly enjoy this aspect of the GCSE course, and this is highly evident during the moderation process. The vast majority of candidates have very good skills when using tools, equipment and machinery. They also have good knowledge and understanding of materials and processes and complete their outcomes well. In some cases, inappropriate materials or methods of manufacture can occur, and obviously this limits the marks awarded.

Lots of candidates use modern techniques very effectively, and the use of processes such as laser cutting, and 3D printing is increasing, and more importantly, used effectively to create innovative and creative aspects within products.

The overall quality of construction of prototypes is generally good, but again this can vary from centre to centre. A small number of outcomes were submitted in a partially or incomplete state this year, and in some instances, candidates had been supported by non-specialist staff within centres which is very worrying, and also extremely limiting for candidates.

The assessment of this area is often generous where centres award high marks when the assessment descriptors in the band below appear more appropriate. Centres are again reminded to cross moderate internally, and especially where candidates produce multi material outcomes. The standardised approach prevents inconsistent application of the marking criteria.

- **Analysing and evaluating design decisions and prototypes – 20 marks**

To obtain a high mark here, candidates need to be able to test a high-quality final prototype on the identified target market and analyse the results. This needs to be supported by on-going evaluation and analysis during the design and development 'journey' where it is intended that the users are closely involved in steering design decisions.

Feedback from users after trialling the final prototype should be analysed and used to help shape any modifications that need to be included to improve the outcome further. There can be further designing opportunities and making activities here.

Many candidates failed to demonstrate the on-going analysis required to access the very highest marks this year. This is an area for development and this new NEA approach progresses. Iterative user centred design must involve the target market and candidate must document analysis, evaluating and decision making more clearly.

Summary of key points

Following moderation, over 95% of centres marks were accepted as accurate and no adjustments were made. This is remarkably high considering that this is a new specification, with different assessment objectives, descriptors and mark bands. Centres should be congratulated on the delivery, completion and assessment of GCSE outcomes.

Some centres will have had an adjustment applied to their marks. This is to bring the candidates into line with the national standard. A small number of centres had positive adjustments applied to their original marks as a result of candidates not being fully rewarded for the work produced. Alternatively, centres which are consistently generous across the sample will have a negative adjustment applied which will reduce the marks of candidates accordingly. Centre reports will indicate whether the assessment of candidates' work was fair and consistent, and provide feedback based on the sample presented for moderation.

- Some centres provided candidates with a **structured format** or **folio template** by which to complete the NEA task. This should be avoided where possible as this guidance will limit the mark awarded to the candidate.
- Some centres prevented candidates from attempting **all 3 contextual challenges**. This restricts the opportunities for candidates to analyse and evaluate broadly and develop the wide range of possible problems required to access the highest mark range.
- There is evidence of a **lack of standardisation** within centres. Teachers should discuss the marking criteria and apply an agreed standard to all candidates within their centre.
- **Proportionate time** needs to be spent on all aspects of the NEA. Some candidates clearly struggled to complete NEA tasks and as a result, final evaluations were sometimes found to be incomplete, superficial or rushed. Some candidates spent too much time on research and investigation activities which were not particularly relevant or focused, and as a result did not help candidates understand the design problem more clearly.
- **Awarding accurate marks** is critical to ensure that candidates receive fair and consistent reward for the work produced. Banded mark descriptors help to determine the correct band where a candidate's work fits, and then within the band, the exact mark that the work deserves.



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